ACORN·USER

BRITAIN'S BIGGEST MAGAZINE FOR THE BBC MICRO · ELECTRON · ATOM

OCTOBER 1984 £1



TRAILBLAZERS:
The origins of life on a BBC micro

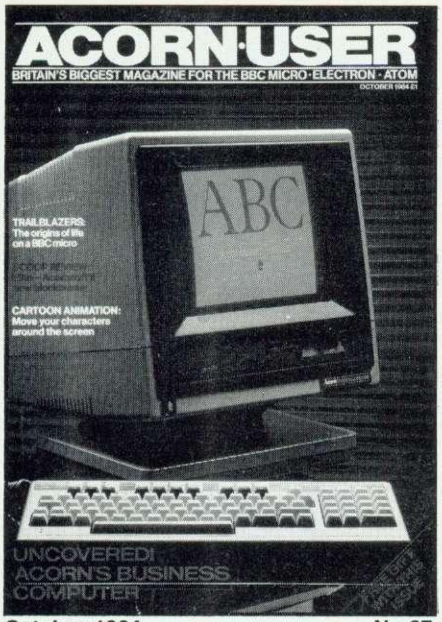
SCOOP REVIEW:
Elite – Acornsoft's new blockbuster

CARTOON ANIMATION:
Move your characters around the screen

UTILITY ROMS:
We pick the best of six toolkits

UNCOVERED! ACORN'S BUSINESS COMPUTER

FREE GIFT WITH THIS ISSUE



October 1984 No 27

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Acorn User welcomes submissions from readers. Articles should be typed, double-spaced text, with diagrams on separate sheets. Please enclose programs on disc or cassette, with a listing if possible. Photos should be 35mm, or larger, transparencies, or 5in by 7in black and white prints. Ensure your name is on everything. Please include a suitable stamped, addressed envelope for return. Articles are acknowledged on receipt.

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THE ONE AND ONLY BBC, ELECTRON AND ATOM MAGAZINE

New Users

First Byte 33
Keyboard capers Start making music and other noises on your Electron, under the baton of Jeremy Vine

Fly Killer Tessie Revivis's asterisk turns into a full-blown fly that runs the gauntlet of the spray can. Design and move your own screen characters with deadly accuracy

Hints & Tips 51
Martin Phillips explains points that perplex readers: printing with daisywheel and dot matrix connected at the same time; outmoded operating systems; a scrolling text window; off-the-shelf procedures; and the ENVELOPE statement

Letters 59
What's on readers' minds? The 6502 second processor, professional typesetting from wordprocessors, high-scoring hit men, comparative reviewing

Dear Kitty . . . 62
What's the difference between ROMs and EPROMs? How do I know which software to buy?

Features

Trailblazers 27
In the first in our new series focusing on the more exotic uses that the Beeb is being put to, Chandra Wickramasinghe explains how his micro helped him advance a startling theory of life in space

Chipping in 81
By programming the Beeb's 8271 floppy disc controller chip you can increase your data-handling power, says Richard Harris

All sorts 117
See how sorting techniques work and you'll soon be able to pick the right one for the job. George Hill sorts them out

Self-diagnosis 123
In the interests of cost-cutting and keeping your micro on the road, Paul Beverley helps you set up tests on the Beeb to diagnose its own ailments

Education

Primary scream 133
The government claims success for its 'micros in primary schools' scheme, but is it of much help in practice? To Geoff Nairn the satisfied smiles look like smugness

Modules by Microtext 137
Ian Birnbaum assesses Acornsoft's Microtext authoring system, which allows even inexperienced programmers to set up instructional quizzes and tests on the Beeb

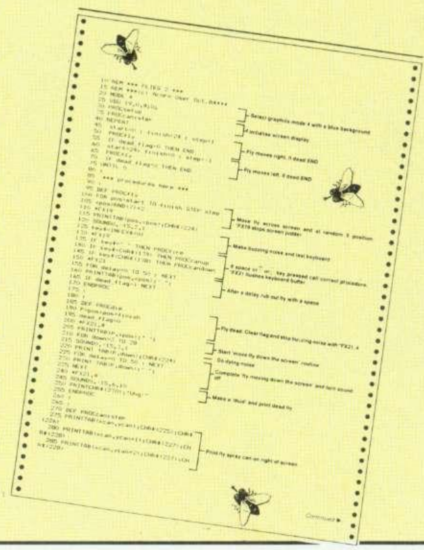
Atom

Wordprint 143
Alex Wilson provides Atom users with a wordprocessor that makes full use of all script facilities

Yellow listing pages

You'll find all the main listings of this issue in the yellow pages

First Byte 97
Our fly gets its come-uppance
Hints & Tips 99
Simple envelope generators
Animated sprites 100
Move your character around
8271 programmer 102
Disc copier
Beeb Forum 103
Disc catalogue reader
Sorting 104
Demonstrated in colour!
Self-diagnosis 107
Choose a test routine
Atomic text 109
Wordprocessing on a shoestring
Toolkits 112
Sample utilities



CONTENTS

Communications

Bulletin boards 167
The social side of communicating by computer is represented by bulletin boards, or free public access systems. Jeff Ashurst briefs you on how they operate, the equipment you'll need to become a registered user, and which BB to join

Reviews

Toolkit trials 157
Bruce Smith compares a fistful of Basic utility ROMs

Elite squad 165
Elite is Acornsoft's secret new space game. Tony Quinn is our test pilot . . .

Games 173
Blagger and *Bugblaster* from Alligata; *Horse Race, Pool, Corporate Climber* and *Lemming Syndrome* from Dynabyte; Screenplay's *Chickaroo;* First Byte's *Star Trader;* DACC's *Super 7* compendium; *Trench* by Virgin; *One to Nine* by Acornsoft; and *A Maze in Space* by Opus

Hardware 185
Sideways ROM sockets by Viglen and NMC give convenient and cheap expansion on the Beeb. Chris Drage compares them

Utilities 190
Bearsoft's Editor ROM; Watford's Buffer and Backup ROM; and Ampersand's Colour Module

Regulars

The News 7
Acorn's ABC – the specs, the facts; the Electron Plus 3, with 3in disc drive; instant program-entry with the MEP's bar-code reader; software on cable TV

Beeb Forum 113
Bruce Smith presents . . . NFS update; security for data files; testing the RS423; and finding the file-length

Top 20 software 155
Curse you, Caveman!

Free ads 201

Small ads 207

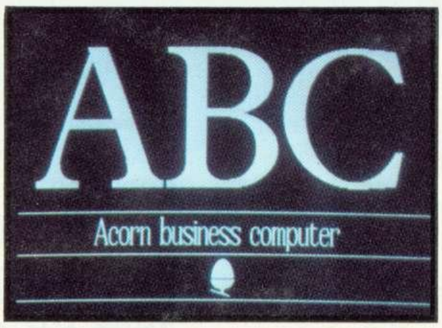
Acorn Abuser's Diary 184
Curried eggs and cabbages

IN THIS ISSUE. . .



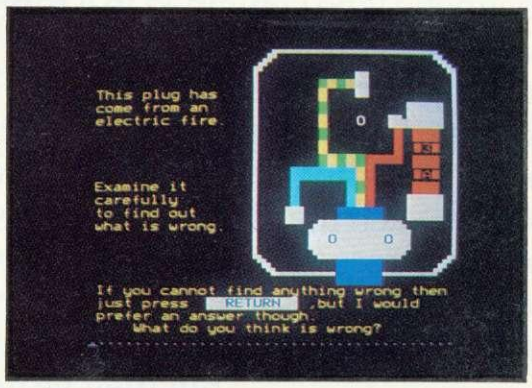
Origins of Life 27
Chandra Wickramasinghe explains how he and Sir Fred Hoyle are using the humble BBC micro to help them research the origins of life on Earth and back up their theories on microbes coming from space





Cartoon time 65
How to move the sprites designed last month. Look out for the free demonstration to download on **Micronet** and **Viewfax**

EXCLUSIVE 7
Acorn's new computers
ABC is the name for the company's new range of business machines. Read the facts, not the guesswork



Acornsoft's Microtext 137
The National Physical Laboratory developed this language to help people who were new to programming write training and educational software. Ian Birnbaum reveals how well it succeeds

NEXT MONTH. . .

Bar codes come of age
We preview the MEP bar-code reader and present listings that can be input using this device

Buggies and Turtles
Six of these robots for schools and hobbyists are given a thorough going-over

Sideways ROMs
Joe Telford studies the popular chips and what will work with second processors

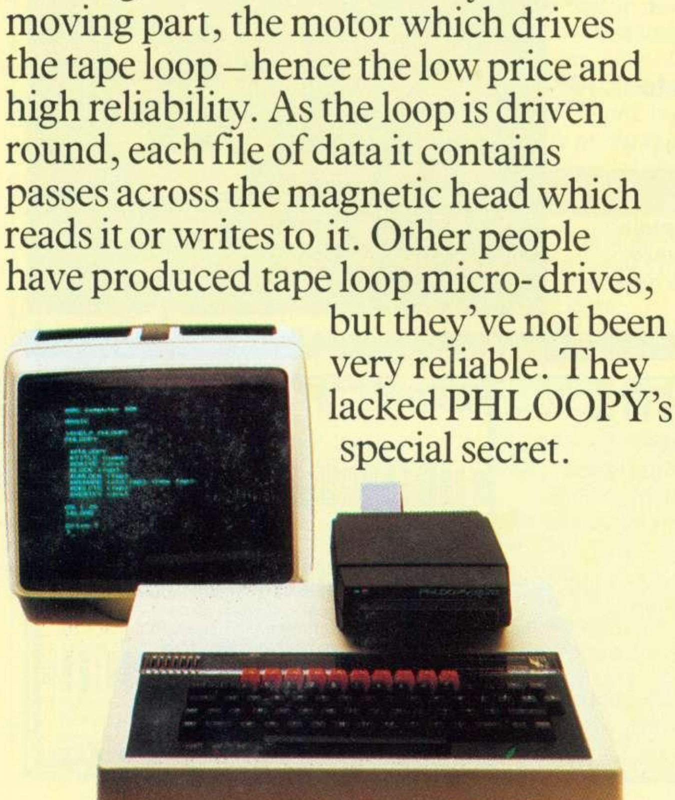
EUREK

A 100k BBC-drive for £99 + VAT

We've done it! We've built a mass storage system for your BBC Micro with the power and convenience of a floppy disk drive, but at a fraction the price. Get to know PHLOOPY, the remarkable new 100k drive that costs only £99 plus VAT, and a further £26 plus VAT for the interface to your BBC, operating system and connecting cables.

How PHLOOPY does it

PHLOOPY does not use disks to store data, but a 12-foot loop of professional - quality quarter-inch magnetic tape contained in a robust cartridge. The drive has only one moving part, the motor which drives the tape loop – hence the low price and high reliability. As the loop is driven round, each file of data it contains passes across the magnetic head which reads it or writes to it. Other people have produced tape loop micro- drives, but they've not been very reliable. They lacked PHLOOPY's special secret.



PHLOOPY's special secret



The heart of the invention is a brilliantly designed "byte-wide" magnetic head, made by Phi Magnetronics who build multi-track heads for professional use. PHLOOPY's head records and reads nine tracks across the width of a quarter-inch tape. That means the tape loop can be much shorter, so the typical time to access a file is reduced to a mere 3 seconds. If you're used to waiting for a cassette tape to trundle programs into your BBC, you'll be amazed at PHLOOPY's performance.

Getting it right every time

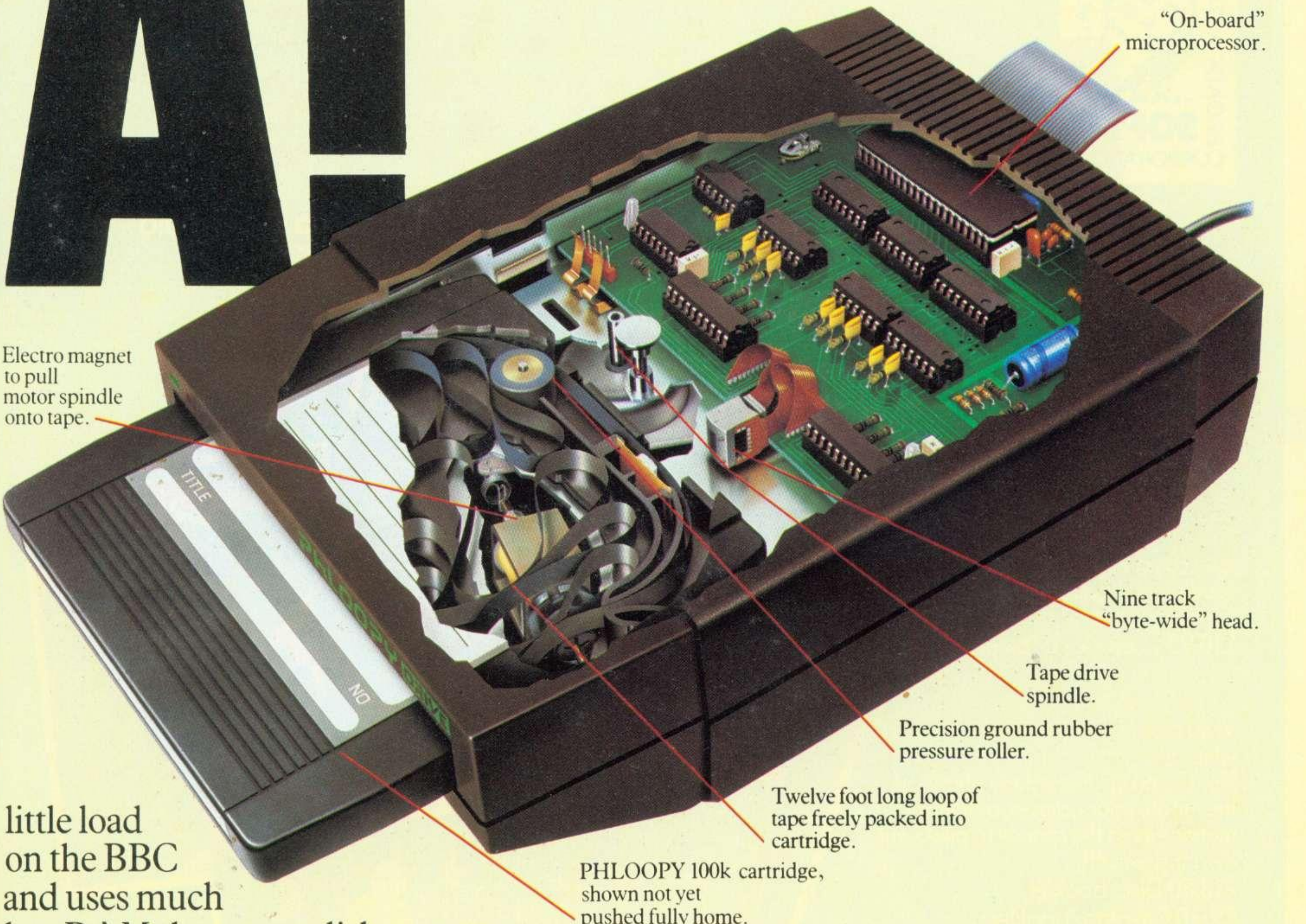
In addition, we've included a feature we know you will appreciate. PHLOOPY has full error detection and correction, so you can be certain you will get back what was originally written onto the tape.

Talking to your PHLOOPY

PHLOOPY's own software, contained in ROM, responds to standard BBC filing system and Basic commands. Most programs written to run on disk or cassette should run on PHLOOPY without problem.

And because PHLOOPY contains its own intelligent microprocessor – a second computer which does most of the hard work – PHLOOPY puts very

KA!



little load on the BBC and uses much less RAM than most disk systems.

Installing PHLOOPY on your BBC

You'll be amazed how simple it is to install PHLOOPY. Just plug in the interface cut two resistors (clearly marked in the instructions) and the job is done. If you should have problems our engineers are waiting to help you.

Making a PHLOOPY Library

PHLOOPY cartridges hold a full 100k of data or programs. Two of them come free with the drive and extra ones cost £3.75 each plus VAT. They are moulded of high impact polymers for protection and store easily on a bookshelf. Many programs will be available to purchase on PHLOOPY.



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Cornwall TR11 3TD.
Telephone: (0326) 76040.

Order Form

- Please send me further details about the PHLOOPY 100k data storage system for the BBC Model B.
- Please send me______(qty) PHLOOPY starter pack(s) for my BBC Model B microcomputer, including PHLOOPY drive, BBC interface, leads, connections, operating system in firmware, manual, and two PHLOOPY 100k cartridges, at £147.75 each including VAT, postage and packing.
Amount £______
- Please send me______(qty) packs of 5 PHLOOPY cartridges at £19.75 including VAT, postage and packing.
Amount £______

I enclose a cheque/PO for £______ OR Please debit my Access card: Number:______
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AU10

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Transform your computer into a letter writer, a chess master, a design aid – with these high-quality programs from BBC Publications.

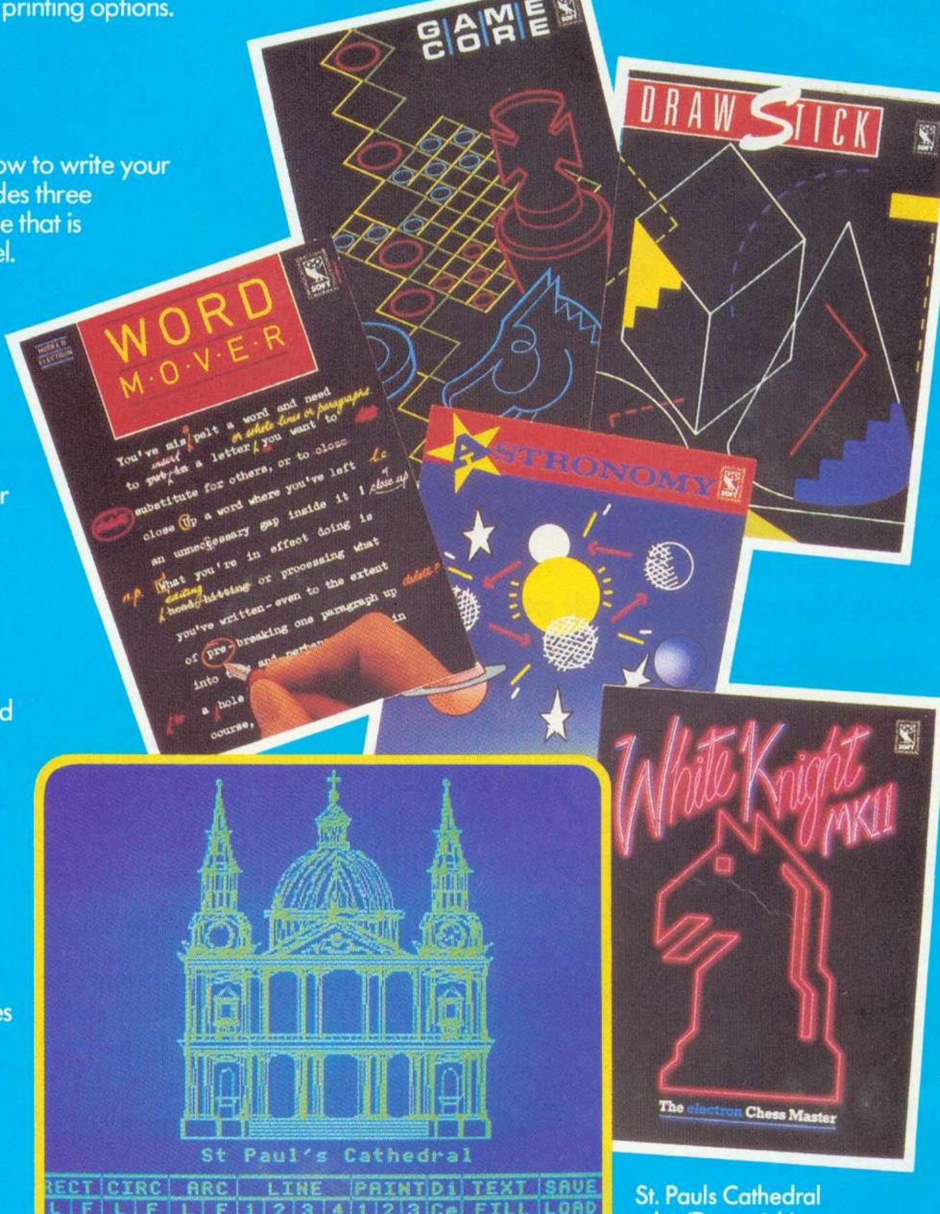
Word Mover
An easy-to-use text editor offering many of the facilities of a word processor – but none of the complications. It gives you a wide choice of display, editing and printing options.
£9.95 Cassette/booklet
For Model B or Electron

Game Core
This intriguing package shows you how to write your own computer board games. It includes three ready-made games, and a fourth one that is explained in detail as a tutorial model.
£10.95 Cassette/booklet

Astronomy
Vivid graphical demonstrations which bring astronomical subjects to life. The programs include phases of the moon, solar eclipses, planetary motion – even the chance to pilot your own spacecraft!
£13.80 Disc/booklet
£9.20 Cassette/booklet

Drawstick
This friendly program can produce elaborate high resolution pictures and patterns in four colours. It enables children to create pictures, charts, maps and diagrams, and can be used as a Computer Aided Design tool. It includes a fast 'save' routine.
£9.95 Cassette/booklet

White Knight Mark 11
This powerful chess program is now available for the Electron. It outclasses and outplays several well-known chess programs, and compels even experienced players to treat it with respect!
Cassette/booklet
Model B version £11.50
Electron version £9.95



St. Pauls Cathedral – by 'Drawstick'

ELECTRON USERS! Word Mover will run on your Electron. An Electron version of White Knight is now available

FROM BOOKSELLERS AND SOFTWARE DEALERS

All software is for the British Broadcasting Corporation Model B Microcomputer except where indicated. Every pack includes full documentation. Prices include VAT.

40813

New Acorn micro



SCOOP: first sight of Acorn's much-awaited business computer

ACORN'S new business range will be based around a repackaged BBC micro with two 16-bit second processors available. There will be eight variants under the generic name ABC – Acorn Business Computer.

Top of the range is the ABC310 running an Intel 80286 second processor giving IBM PC and XA (Popcorn) compatibility, with ikon software and high-resolution graphics.

The 16-bit operating system will be Concurrent, a development of version 3.1 from Digital Research. It is capable of performing several tasks at the same time and dividing the screen into windows.

As our picture shows, a full professional keyboard with separate numeric keys links to a box containing the 6502 processor used in the Beeb, topped by a monitor.

The monitor tips forward, giving access to internal sockets where second processor and hardware cards can be added.

The machines should be on view at dealers in November, with deliveries starting in the New Year. The whole range

EXCLUSIVE

should be available by Easter, says Acorn. Prices have yet to be released.

Bottom of the range is the Terminal, which is exactly what its name says. It will not be expandable, and comes with terminal emulator software and Econet as standard. The monitor is a 14in monochrome with 32k RAM and no disc drive.

Next up is the Personal Assistant wordprocessor. It comes with one double density, 5.25in drive giving 700k of storage. A 12in monitor comes as standard, as do View and Viewsheet. Second processors and other hardware can be added, right up to the top of the range configuration.

The ABC100 includes the Z80 second processor running CP/M and two 700k drives as standard. The three Plan software packages are included, and have been enhanced (see June's *AU*). The ABC110 is similar, but with one drive replaced by a 10Mb Winchester hard disc and colour monitor.

Whereas the 100 machines cover office productivity, the ABC200 and 210 are loosely described as 'academic workstations'. The 32016, the 16/32-bit chip is included with disc variations as above. Standard RAM is 256k. A choice of programming languages will include C, Modula2 and Pascal. The Xenix operating system comes with the Winchester on the 210.

Flagship of the series are the 'executive workstations' with the 80286 16/24-bit chip. The 300 will carry two 700k drives and monochrome moni-

page 9▶

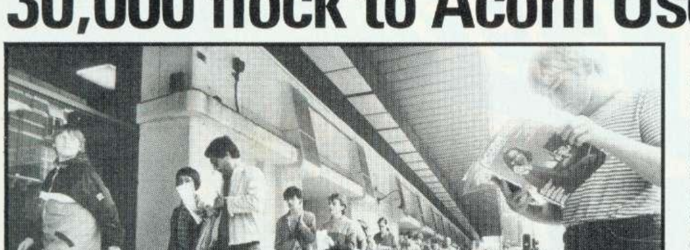
Electron Plus 3 disc interface – page 9

Using your free function key strip

THE FREE gift on this month's front cover is designed as a re-usable function key strip for BBC micros and Electrons.

Using a chinagraph pencil (about 30p from art shops), you can mark in key definitions for your own programs. It slots under the BBC's clear plastic strip, or can be taped onto the Electron. We hope you find it useful.

30,000 flock to Acorn User show

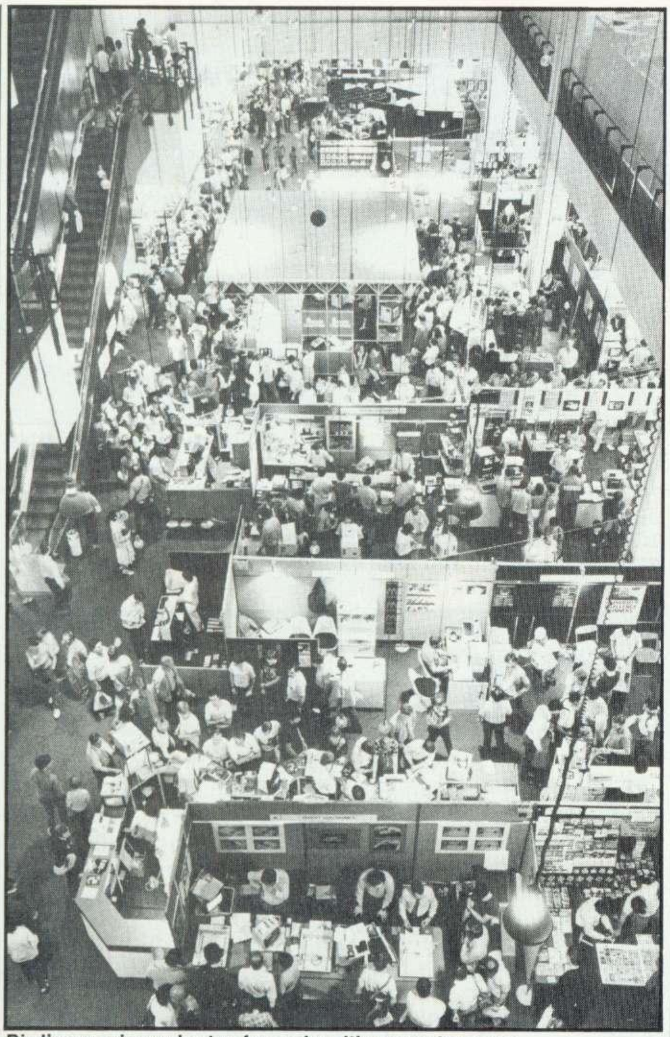


THIS year's Acorn User show was the first to be held at the new Olympia 2 exhibition hall. More than 30,000 people passed through the turnstiles over four days, but with the new venue there was little of the overcrowding which dogged last year's show.

Acorn had the largest stand running 'live' demonstrations. Said Acorn's Graham Winnard: 'For the first time we're using technical people instead of sales staff to demonstrate the products. The demonstra-

page 9▶


QUALITY NEVER LOOKED SO GOOD–
Now everyone with a BBC or IBM PC will want to get their paws on CUB's sleek new D series plastic cabinet – a triumph of ergonomics and up to the minute design. Within it is the CUB 653 MEDIUM RESOLUTION colour monitor – the perfect mate for computer users who wish t combine the advantages of brilliant, low cost colour graphics with 80 column processing software.
CUB 653's remarkable depth of colou is enhanced by minimal screen glare thanks to a super high contrast CRT. Even in well lit environments the 653 (H) × 585 (V) resolution and 0.43mr dot pitch produces 80 columr text which is pin-sharp and easy to read. Owners of SHARP, RML 480Z, APPLE Series, WANG and other leading computers needn't feel left out, because CUB 653's compatibility extends t these models and many more.
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1984
Available from High Street Computer Retailers and selected branches of W. H. Smith, Harrods, John Lewis Partnership, John Menzies with selected models available from larger branches of Boots.


Bird's eye view: plenty of people with space to move

Show hit

◄ page 7

tions have been very successful and attracted a lot of interest.'

Three new 'add-ons' for View and Viewsheet were announced: a Printer Driver Generator at £9.95 (£11.50 disc); View Index, for producing an index of pages, at £14.95 on disc only; and Hi-View, a £59.80 version of View to use with the 6502 second processor.

Hi-View offers more free memory than the ordinary View but is only available on disc – the high price is to protect sales of the ROM-based View.

Torch, now part of Acorn, was showing off the Graduate, the add-on which makes the BBC IBM PC-compatible. 'We're getting a lot of interest from large companies, education and small businesses. If you put an order in now you could get one in November,' promised Adam Lewis.

Making a debut was a £65 robot construction kit from Micro Robotic Systems. Using Fischertechnik parts (as used in the BBC Buggy) several different experiments can be built. With the addition of a £32 interface, the experiments can be controlled from the BBC micro. Experiments include: a plotter, a robot arm, Tower of Hanoi and a sorting system. Micro Robotic Systems is at 20 Penywern Rd, Earls Court, London SW5 9SU.

The first mouse for the BBC micro was on the AMS stand. The designer, Dave Brader, was still working on the software, but it appeared to provide a much quicker method of editing text and drawing graphics.

The device has been curiously renamed the AMX Mouse and will go on sale in October for £79.95. Dave was also promising an EPROM programmer – though it wasn't available in time for the exhibition.

Electron gets microdrives in Plus 3 box

ELECTRONS will not come down in price at Christmas says Acorn, and a big sales push will be headed by the Plus 3 add-on incorporating a 3.5in disc drive.

The machine will be promoted as the basis of an expandable system which will be around for a long time, with Plus 3 proving the point. Extra hardware can be plugged into the spare cartridge socket on the Plus 1 to add interfaces such as RS423.

No firm price has been announced for the Plus 3, but it is likely to be about £250. This includes the drive and interface in the add-on box.

Special deals will be offered on combinations of Electron and add-on boxes or software, as with the Me and My Micro pack released last month.

The missing Plus 2 will supply Econet and won't be out until next year. View and Viewsheet will be released for the Electron before Christmas.

Acorn's choice of the 3.5in drive will no doubt anger the existing microdrive market for the BBC micro, which has plumped for the 3in version. However, Acorn decided the standard will be fixed by the big business companies going for the larger format.

The Plus 3 uses the newer 8272 floppy disc controller chip as in the ABC machines. The BBC micro uses the 8271, which is in short supply and cannot support double density discs.

Micros live on BBC TV

BBC TV's new computer magazine series, Micro Live, will go out monthly from Friday, October 5.

Leslie Judd, of Blue Peter fame, and Ian McNaught Davis will be up front, with special reports on America by Freff from June's Micro Live.

Producer Patrick Titley explained that the shows will go out live and have a topical flavour. 'It will be a fast moving magazine programme – like a printed magazine.'

There will be six programmes, each lasting 30 minutes on BBC2, probably at 6pm.

A bulletin board will be set up for viewers – and Patrick Titley hopes *Acorn User* readers will contact them with news stories.

New micro

◄ page 7

tor while the 310 will have a single drive plus Winchester and colour screen. Again 256k RAM is standard, but upgradable to 1Mb.

A mouse will be released next year for the 300 machines, along with a modem card for the range.

Interfaces are as on the BBC, but with no TV socket and some of the connectors will be changed.

Howard Fisher, ABC project leader, said: 'Our research shows people want computers that work, and this range has been designed to meet needs we have identified. They match very specific requirements.'

On the question of performance, he declared: 'The 80286 machines are up to five times faster than the IBM PC on benchmarks.'

Tom Hohenberg, Acorn's marketing manager, added: 'The ABC range is a neater alternative for the BBC micro, aimed at business users. There is no conflict with the BBC itself.

'We've gone for a modular technique to save space and make it a doddle for the engineers.'

Bar code listings aim to cut down typing

BAR codes are set to become more than just things on cans of beans with the launch of a reader pen for the BBC micro in October costing £50.

And *Acorn User* will be supporting the project by Addison Wesley, which has MEP backing, with program listings printed in bar code.

Schools will be the initial target, but a consumer pack will follow. The pen enables people to enter software without any typing and produce actual listings in the form of bar codes for distribution.

A pack consists of the reader pen, which measures 2 × 4 × ½in, cassette or disc with demonstration and driver programs, template for producing bar codes by hand and a user guide written by AU author George Hill.

The software will decode the bar system used in supermarkets and there is a music program.

For more details contact Addison Wesley at Finchampstead Rd, Wokingham, Berks RG11 2NZ.

See next month's issue!



TAXAN has released two centronics NLQ printers. Their main forte is the near letter quality print (NLQ) of the dot matrix head. The two models, the KP810 and KP910, feature 160cps bi-directional printing, a half speed 'quiet' mode, friction and adjustable tractor feed plus roll paper. Both are available at £229 for the KP810 and £399 for the KP910 from Data Efficiency, Maxted Road, Hemel Hempstead, Herts.

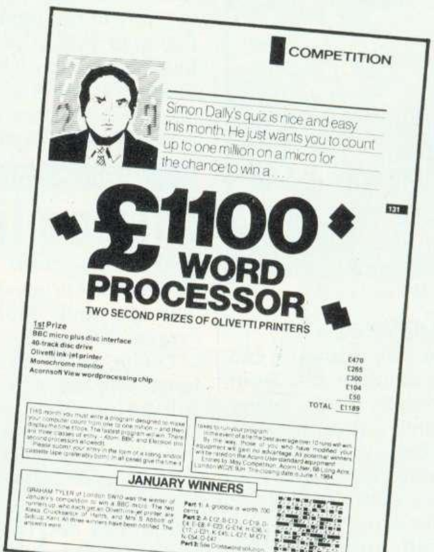
One winner from 8000 entries

THE competition set in May's *Acorn User* was the most popular ever. To say we were overwhelmed at the response would be a gross understatement – more than 8000 readers entered! The incredible response, with some excellent and thought-provoking solutions, has been the prime factor in the result being delayed and we thank you for your patience! Now to the competition.

You will remember that Simon Dally set the task of counting from 1 to 1,000,000 in the quickest time possible. The first task for most of you was to decide what was meant by 'counting from one to one million' – but that was all part of the competition.

Many entries were based around using the two user and two system VIA timers to 'count' in around 0.25 seconds. These entries were disqualified because they did not count to a million – they simply counted to 250,000 each. Although the sum of the four counters is indeed 1 million, the rubric clearly stated count from one to one million.

The second most common entry was based on the fact that the computer performs so many operations in so many cycles. With the Beeb operating at 2MHz it would be possible to determine when a million cycles had been performed simply by creating loops of machine code that contained a set number of cycles. The quickest time would therefore be 0.5 seconds. However, entries using this technique were discounted because, again, a physical counter incrementing from one to one million was not involved.



'After a final four-hour deliberation the winner was chosen'

The acceptable solution was to use 24 bits anywhere within the Beeb that would be loaded with 1 and then incremented to a total of one million. The three bytes needed to do this could have been the three processor registers, three memory locations or a combination of each.

After much sorting and sifting, the 8000 entries were whittled down to a final selection that all used the three-byte counter and all gave results of one second, or fractionally over. After a final four-hour deliberation late one Friday night the winner was chosen; John Faris from Oakham in Leicestershire. John's time was a staggering 1.004856 seconds.

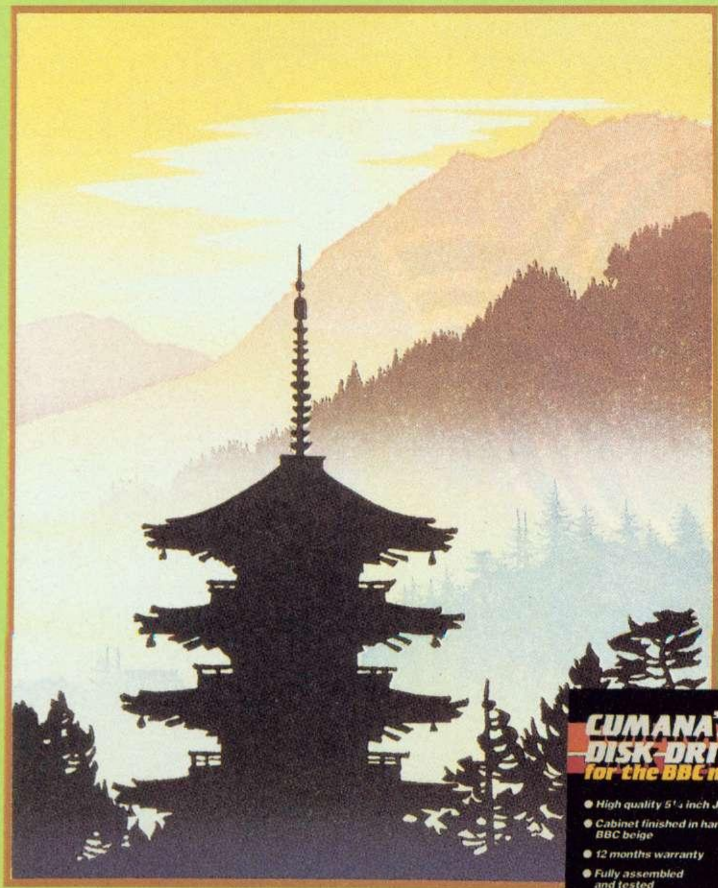
Now, all you readers who had times of 1.00 or 1.004 seconds – don't write in. The level of timing accuracy varied and all times of one second, plus a fraction, were considered in the final analysis.

John used the accumulator (least significant byte), X register (middle byte) and a zero page RAM location (most significant byte) to act as his counter. The program was written in assembler and used macros to assemble sets of the appropriate incrementing instructions. Extra speed was gained by turning off the system timers to inhibit the household interrupts issued every 10msecs, giving around a 5 per cent increase in speed.

So £1200 of wordprocessing equipment wings its way to John Faris with our hearty congratulations. Two second prizes of Acorn spark-jet printers go to Chris Wedge of Folkestone and Colin Edwards in Sussex. In addition, we are giving a special prize to the slowest entry. This is not intended as a booby prize, but as a reward for entering the competition in the spirit in which it was intended.

Finally, we are unable to enter into any correspondence regarding the competition. All decisions are final.

Once again, congratulations to all prize winners and thanks to everyone for entering.



Print from Japan

Disk Drives from Cumana



Like the beautiful prints from Japan, Cumana disk drives represent the very highest standards in design and production. Also like the prints, Cumana disk drives represent the highest state of the art; and they not only look beautiful, they perform beautifully as well.

Cumana disk drives for the BBC Microcomputer are available in slimline single, dual and dual switchable versions. They have 12 months warranty, are fully assembled and tested before packaging, and are available — at unbeatable value for money prices — from W. H. Smith, The John Lewis Partnership, Greens Leisure, Laskys, Spectrum UK, area distributors (see below) and Cumana's national dealer network.

Look out for the distinctive Cumana packaging in your high street, today!

Area distributors:
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Note: If dealer, please attach this form to your letterheading.

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From only £764.00 the new Torch Graduate will upgrade your BBC Model B to a powerful 16 bit business computer

TECHNICAL SPECIFICATION

- 8088 16-bit processor running at 5 Mhz
- 128K or 256K RAM
- MS™-DOS operating system customised to IBM compatibility
- Model G400 – Single, double sided, high density disc drive (320K formatted)
- Model G800 – Twin, double sided, high density disc drives (640K formatted)
- Integral stabilised power supply
- 2 IBM PC compatible hardware expansion buses
- Software compatibility allows Lotus 1-2-3 and all popular IBM PC business programs to run without modification, subject to the constraints of the BBC keyboard and display
- Disc interface is not required

Keyboard text and graphics supplied by BBC Model B

• THE GRADUATE •

Disc and hardware compatible with the IBM PC, the Graduate is the latest addition to the Torch range of BBC upgrades. It's MS™-DOS operating system is customised to IBM compatibility allowing exploration of the massive range of IBM compatible business software, programming aids, compilers and languages universally available from most major software houses.

Introduction to MS™-DOS

The Graduate offers two levels of upgrade, the G400 and the G800, both with 128K on board user memory as standard (optionally 256K). This can be increased to 1.2 Mbytes with an IBM compatible expansion board. The G400, contains a single, double sided 320K formatted disc drive and provides the low cost introduction to MS™ -DOS for the user who wants real 16 bit power from his Model B.

More data storage

A step up from the G400 is the G800 which offers twin, double sided 320K disc drives for extra data storage. Both the G400 and the G800 provide the possibility of further expansion for networking, modems, etc., via the IBM compatible hardware slots provided by the Graduate models. Each model comes complete with a well written user/technical manual and connecting leads.

Just plug it in

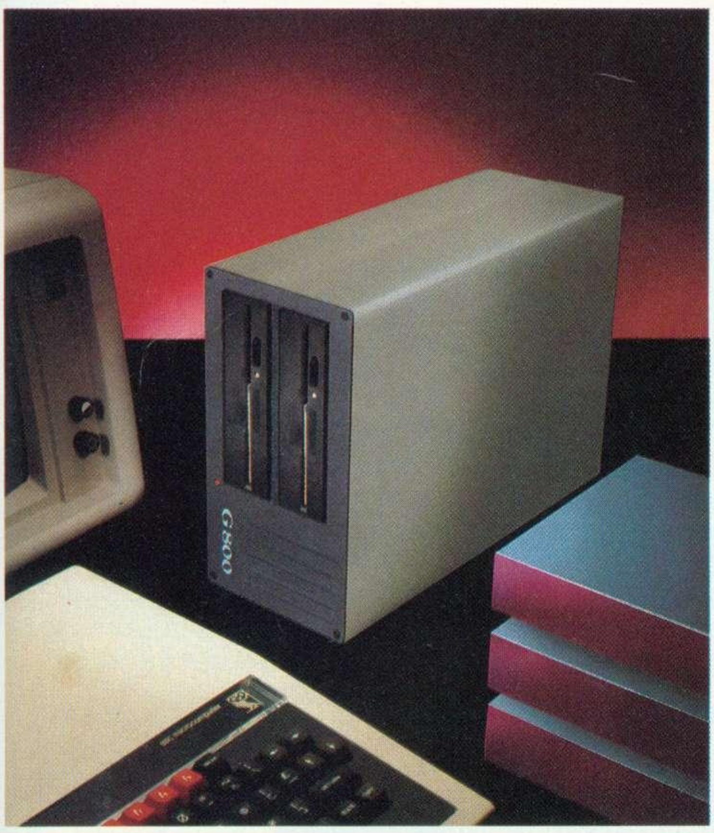
Unlike other add-ons there is no need to open the BBC to make the connection. The compact and tidy Graduate models simply plug in to the 1MgHz bus on the Model B. Within minutes you can be up and running with an IBM PC compatible system that really means business.

The range

Add 256K RAM, 640K disc storage and IBM PC compatibility to the BBC Micro for less than £1,000.

Graduate G400 (128K) £764 inc. VAT
Graduate G400 (256K) £815 inc. VAT
Graduate G800 (128K) £949 inc. VAT
Graduate G800 (256K) £999 inc. VAT

For further information complete the coupon today.



TORCH COMPUTERS

Lighting the way ahead.

Torch Computers Limited
Abberley House, Great Shelford, Cambridge CB2 5LQ.
Telephone (0223) 841000. Telex 818841 TORCH G.

The Graduate is manufactured by Torch Computers under licence from Data Technologies Ltd.

To: Torch Computers Ltd., Abberley House, Great Shelford Cambridge CB2 5LQ. Telephone (0223) 841000
Please send further information on the Graduate and the address of my nearest dealer.

Name ______________________

Address ______________________

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Post Code ______________________

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AU10


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MD 400
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BBC Compatible
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These are high capacity, precision drives with dynamic clamping and very low power consumption. All drives are supplied with cables, a very comprehensive utility/format disc and a manual.
MD 400 — 400K (800K double density) 40/80 track switchable double sided single drive.
MD 800 — 800K (1600K double density) independently 40/80 track switchable double sided dual drive.
MD 800P — 800K (1600K double density) independently 40/80 track switchable double sided dual drive unit with built-in power supply and monitor stand.
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Cable TV to transmit software for micros

A SPECIAL cable TV service aimed at home micro users is set for launch next year. Information and software will be transmitted as teletext by Thorn-EMI, one of the largest entertainment groups in the UK.

Adapters will be needed to download telesoftware, but the information pages will be accessible by anyone with a teletext television set. The service will be restricted to subscribers in major towns.

Unlike broadcasts by the BBC and IBA, where teletext information is transmitted between television frames, Thorn-EMI's service will be 'full-field'. This means that the whole cable channel is given over to teletext.

Richard Wolfe, who heads the project, said: 'The channel will transmit 5,000 different pages every second. Each month the subscriber will be able to download between 20 and 100 different programs.

'This year we're still in an exploratory mode but we should have a commercial service running in autumn 1985.'

Thorn-EMI already transmits teletext with the Music Box cable service, but it's squeezed between the picture frames in the conventional manner. At the moment it runs to 20 pages of music-related material: the Top Ten, tour news and video reviews.

Music Box logo

Music Box will be available in about 40 towns by September to potentially one million homes. For £5 a month you get Music Box and three other channels. Premium services – for feature films and the like – cost about £7 a month extra. The full-field teletext service will be a premium channel.

Richard Wolfe explained: 'We're waiting for full-field teletext chips to come out next year before deciding on the hardware. Obviously with the telesoftware pages we're looking for adapters for the popular home micros and certainly the BBC micro will be one of the machines we'll go for.'

A full-field teletext service can offer many more pages than the IBA's Oracle, so rather than trying to compete in the mass market the IBA is revamping Oracle to attract commercial customers. As revealed exclusively in *Acorn User* last month, the IBA intends to add subscription-only pages of specialised information – the latest Stock Market prices for example.

As the Bill to permit this went through Parliament, John Gorst MP had suspicions that by charging for teletext pages, 'the IBA may now, in a back door way, be entering the interactive services of cable television.'

Douglas Hurd, the Home Office Minister set him straight: 'The IBA is talking about a one-way service, whereas interactive services are, by definition, two-way.'

When asked about whether the IBA had considered full-field teletext, Pat Hawker, a technical spokesman, commented: 'Unfortunately there are no spare channels for broadcasting full-field teletext. Instead we are expanding the conventional teletext service and will add some subscription-only pages for commercial users.

'Using Oracle, you can't go much above 100 pages before the access time gets too long. Full-field teletext potentially offers 100,000 pages with similar access times to Oracle.'

The IBA was hoping to run a full-field teletext service using the now-obsolete VHF television channels. Unfortunately the proposal was turned down and the channels went to cellular radio.

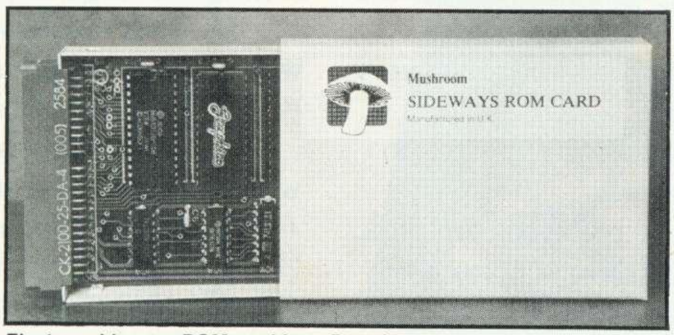
Electron board runs BBC firmware

THE Electron can now use software on a chip intended for the BBC micro. Broadway Electronics' sideways card costs £29.95 and can hold four sideways ROMs.

The company claims it will work with about 60 per cent of BBC ROM software, but not View or Wordwise.

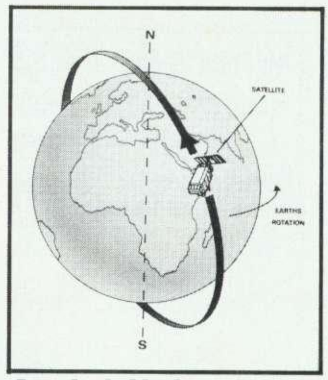
It plugs onto the Electron's edge connector and further expansion cards can then be plugged into the ROM card. Also available are a £45.95 user port/printer interface and a £39.95 analog interface.

These use the same chips as the BBC micro and so have the same features.



Electron sideways ROM card from Broadway

Further details from Broadway Electronics at Aston Road, Bedford, Beds MK42 0LJ.



Aerial links to satellites

FOLLOWING on from August's article on downloading weather satellite pictures, Weston Developments is offering a suitable aerial for £31.75 (plus £4.50 p&p). Called WB6/Uosat, it is specifically designed for receiving satellite signals on the 136MHz band.

You need your own cable, but a filter box is available at £9.85 to match cable to aerial.

Further details from Roger Bunney, Weston Developments, 33 Cherville St, Romsey, Hants SO5 8FB.

Ultracalc boost

ULTRACALC, the BBC's spreadsheet chip, has been upgraded. All reported bugs have been fixed and it now works with any BBC screen mode. When running with a second processor, the program is automatically relocated and 45k of memory is then available in mode 0.

Owners of the existing version can get the new chip for a 'nominal' price when it becomes available at the end of this month.

Contact BBC Publications, BBC, 35 Marylebone High St, London W1M 4AA.

School challenge

BRITISH Gas is running a computer-based competition for secondary schools. Using a BBC micro program called Cedric, students have to conduct a survey in homes and suggest a plan for saving energy. The best school entry wins £1000, and there are prizes for individual students.

Teachers can obtain a free copy of Cedric from Mr R Wolfe, Education Liaison, British Gas, 326 High Holborn, London WC1V 7PT. Closing date is the end of the year.



Will you be the first Earthling to win a pl

Acornsoft are issuing a nationwide challenge to all Acorn Electron and BBC Micro users.

It's the challenge to join a new and exclusive group of computer games players: The Elite.

With 3-dimensional graphics, Elite is a game which is light years ahead of any other.

It strictly defines the rank of each and every player.

As your prowess improves, you move into higher ranks.

But make no mistake, to reach the top rank, your performance must become exceptional.

Then, and only then, will you qualify to call yourself a member of The Elite.

<u>From harmless, you must become lethal.</u>

In Elite, all players start as equals.

With the initial rank of "Harmless," you will embark upon an experience unlike any that you have known before.

You will be a space trader who roams the universe, making your living from buying and selling the cargo in your Cobra space craft.

On your travels, you will encounter aggressors who are eager to put an end to your dealings.

Only the fittest will survive.

As you establish yourself as a survivor, you will win the right to a higher rank.

In all, there are nine, from "Harmless" to "Elite." And your computer will continually tell you where you stand.

<u>Trade with 2,000 planets in eight galaxies.</u>

Besides survival, your success also depends on the rewards you reap from the cargo that you carry.



ole among the Elite?

That cargo can be anything from foodstuffs to contraband. If you decide to trade in contraband, the rewards will certainly be higher. But so will the risks you take.

To ply your trade, you can dock at any of 2,000 planets in eight galaxies.

However, before you dock, you must use your wits to assess the planet's political climate and the perils which may be waiting for you.

Also, in any of the eight galaxies, you may find yourself being asked to perform acts of considerable heroism and selfless courage.

Although these will bring you into danger, they can bring considerable rewards too.

<u>We're waiting to recognize your skills.</u>

Achieving higher status in Elite will tax your skills to the limit. Which is why you must download your game onto cassette or disc each time you take a break from play.

When you reach the rank of "Competent" or higher, you should send us the secret code number revealed to you by your computer.

We will send you in return a special document which certifies your achievement. And you stand to win a valuable prize.



<u>Are you ready to accept the challenge?</u>

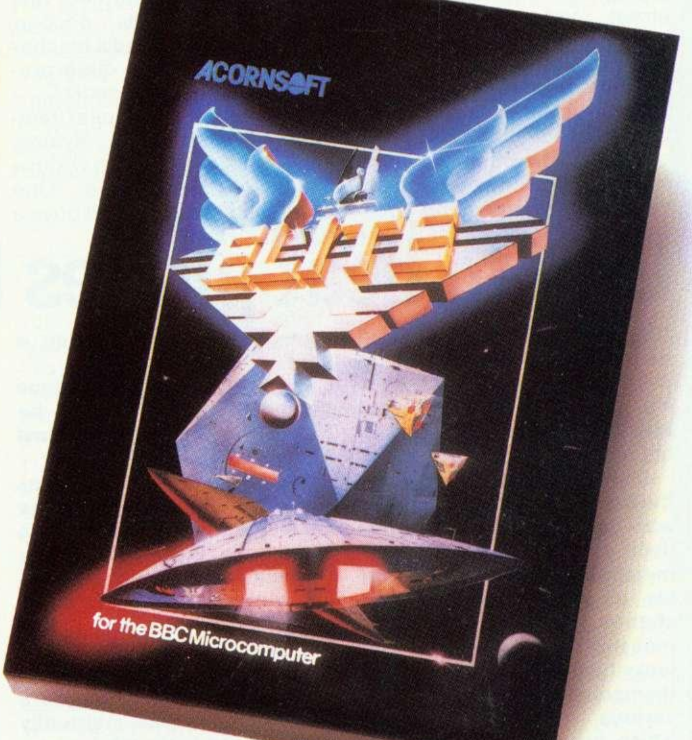
Elite is available on both disc and cassette for the BBC Micro and on cassette for the Acorn Electron.

With either, you will get "Elite: The Dark Wheel," a compelling novel which sets the whole mood of your adventure. You'll also get a flight training manual which will get you fit to roar into the unknown in your Cobra spacecraft.

Your Acornsoft dealer now has the entire package at £14.95 on cassette, or £17.65 on disc (for the BBC Micro) and £12.95 for the Electron. (For the address of your local stockist, call 01-200 0200.) Credit card holders can simply telephone 0933 79300 during office hours.

Alternatively, you can order by post from: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.

You can also get a free Elite poster by ringing 0933 79300.



ACORNSOFT

Geoff Nairn reports on piracy and Bill Penfold looks at the pressure on MPs

Fighting talk on software piracy



TWO software companies have crashed this year and more could follow unless piracy can be stamped out. And it's not just down to a few big-time counterfeiters; if you have ever swapped games with friends then you too are a pirate in the eyes of the industry.

Nick Alexander, who chairs the Guild of Software Houses, claimed: 'For every legitimate tape sold, 10 or 12 copies are made'. Chris Holland of Salamander put the number nearer six but added that 'between £100m and £150m is lost in this country alone each year.'

Imagine collapsed in July and '50 to 60 per cent of the problem was due to copying', said Nick Alexander. He cited how Salford CID seized 10,000 counterfeit copies of Imagine games in one raid. GOSH has set up a £50,000 fund to enable its 34 members to take court action.

Pirates fall into two categories: commercial counterfeiters who make copies by the thousand and pass them off as the real thing; and home users who make just a few copies to sell or swap.

Quicksilva has started a civil action against one group of pirates after 30,000 copies were found in a single raid. Counterfeits had been found in legitimate retail outlets and street markets which were indistinguishable from the originals.

Amateur pirates can be just as destructive. One Blackburn doctor was selling £300-worth of copied Microdeal software for just £30. The company seized all his tapes and documents through the courts, and is now seeking damages 'of several thousand pounds so as to discourage others', according to John Symes of Microdeal. He added that similar actions were pending against a user group and a school.

Acorn's Chris Curry has claimed school computer classes harbour 'a den of thieves'. He told a Parliamentary committee: 'You provide the software to one person and it gets copied throughout the school'. Rod Cousens of Quicksilva goes further, and thinks teachers often encourage piracy: 'If we find a teacher doing this, we are quite prepared to take him to court.'

Retailers have similar feelings. Matthew Hyams, manager of the Lion House store in London said: 'One schoolkid comes in and buys a program while five friends watch. They then all go out together, presumably to make five illegal copies. Some even have the cheek to bring the original back saying it's faulty!'

The user groups have been on the receiving end of criticism. Peter Hughes who runs the Format 40/80 group takes a clear stand: 'Our group is dead against copying. I have had to turn down many applications from people – usually kids – who were obviously only interested in copying software.' However, he admitted his group was probably in a minority as many exist solely to copy and swap games.

The Format 40/80 group caters for disc users and will copy any genuine program tape to disc for members. When it was suggested this be classified as piracy, Peter Hughes replied: 'If you've bought a disc drive, why shouldn't you be allowed to get the benefits? Why should you have to buy a disc version of a program you already own?'

PSS, a Coventry software house, has adopted a policy of not advertising in any magazine which carries adverts for tape or disc copiers. Richard Cockayne, one of the directors, said he was 'fairly appalled' at the attitude of companies who sold copier programs.

He went on: 'In the longer term they are cutting their own throat. There's no need for such devices. We will replace any tape which doesn't load.'

He quoted the case of one 13-year old selling pirate copies of PSS games through the classified columns: 'He was using a commercial tape copier program and had master tapes for 34 titles.'

When it comes to solutions, Nick Alexander differentiated between commercial pirates and the home user. 'For the professional criminals we're trying to get legislation for tougher penalties.'

He drew an analogy with video tape pirates: 'A change in legislation and some well-publicised raids drove them away – to computer software instead.'

For the small-time pirates, technical measures do stop casual copying, but the determined can usually crack protection devices. Nick Alexander hopes to 'appeal to their better nature as he feels legal remedies are inappropriate.

Let's hope his faith is justified.

Law to beat pirates hinges on lottery

ONE raffle in November could be worth £150 million to Britain's computer industry. It's the yearly 'Private Members' Ballot in the House of Commons.

The 20 names plucked out of the hat will be backbench MPs who get the chance to introduce their own private members' bill, but only the first six or eight have any real chance of seeing their measure become law. The lucky half-dozen or so will find themselves besieged to adopt various measures, one of which aims to outlaw pirates estimated to be costing software houses £150 million a year.

Hoping to find a friendly face amongst the MPs will be FAST – the Federation Against Software Theft.

FAST, set up last July, has already got its draft bill on the stocks. In fact the measure has even been introduced in the Commons by Tory MP Nicholas Lyell, although it never had any chance of getting any further.

The situation is similar to video piracy two or three years ago. That was virtually stamped out by tough legislation. Penalties leapt from just £50 on conviction to £2,000 for each offence, plus the possibility of jail.

The software industry hopes to repeat that success with a simple amendment to the video bill which amended the 1956 Copyright Act. The software measure proposes in turn amending the 1983 Act by simply adding after references to video films, the words 'or computer programme'.

Before any Beeb owner begins panicking at what is in their own software libraries, a word of reassurance. Though no one is condoning amateur pirates who borrow and copy software that's not the target.

Ranald Robertson, chairman of the Computing Services Association's legal affairs group, insists FAST is not after the schoolboy pirate, unless he's selling his copies.

'It's the commercial pirates, the blokes who are selling stolen computer software for profit, that we're chasing,' he explained.

FAST's chairman, Donald MacLean, explained that come the day of the draw the Federation will be standing in the queue ready to pounce on the six or eight MPs heading the list.

TECHNOMATIC

BBC Computer & Econet Referral Centre
01-208 1177

OCTOBER 84'

ACORN COMPUTER SYSTEMS

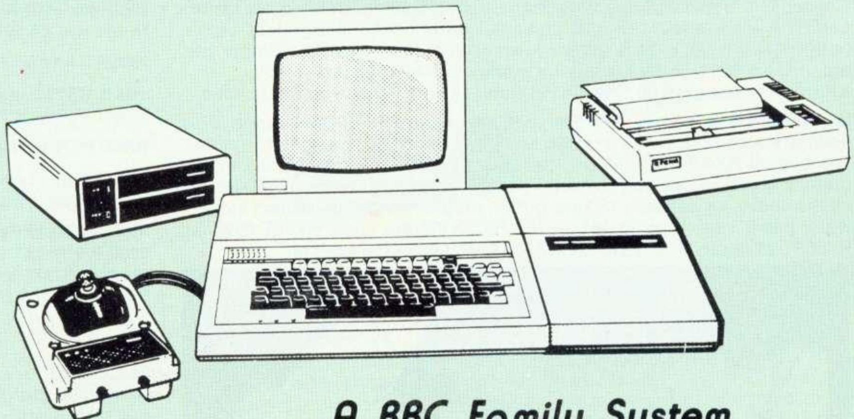
BBC Model B Special Offer	£320 (a)
BBC Model B + Starter Pack	£348 (a)
BBC Model B + DFS	£409 (a)
BBC Model B + Econet	£389 (a)
BBC Model B + Econet + DFS	£450 (a)
BBC Dust Cover	£4 (d)
Pair of Joysticks	£14.50 (d)

UPGRADE KITS

A to B	£65 (d)	Installation	£20
ACORN DFS Kit	£95 (d)	Installation	£15
Econet Kit	£42 (d)	Installation	£25
Speech Kit	£47 (d)	Installation	£15

ECONET ACCESSORIES

Terminator (Two reqd per installation)	£31 (c)	File Server Level II	£216 (c)
Clock with psu	£35 (c)	10 Station Lead Set	£26 (c)
Printer Server Rom	£42 (c)	Extra Econet cable	£1.50/m (d)
File Server Level I	£86 (c)	Econet User Guide	£10 (d)



A BBC Family System

ACORN BITSTICK

The Acorn adaptation of the renowned 'Bitstick' graphic CAD package — the "expensive joystick" that lets you exploit the powerful capability of the BBC micro to the full. The joystick is of a robust design which achieves remarkable precision without fiddliness. Total control is available from the joystick using the on-screen menu. It can draw freehand or follow lines of shapes chosen with high accuracy, and colours can be chosen from a palette displayed on the screen. Any part of a drawing can be magnified, by a virtually unlimited number of times, and upto 48 drawings can be saved on a single disc. The discs use a visual library system for easy identification. Inspite of its powerful features, the Bitstick is extremely friendly and easy to use, due to menus being displayed on the edge of the screens.
£328.00 (a) FX80 dump routine for the bitstick available.

TORCH UNICORN PRODUCTS



The TORCH Unicorn system has been in the field for over two years and is now a proven Z80 system for the BBC. It gives you the potential to expand which no other system can currently offer. You can expand a single system with a 20Mb Hard Disc, have the processing power of a 32bit 68000 cpu with 256K ram and a UNIX operating system, or set up a network of upto 254 machines. All these capabilities are available NOW.

The TORCH UNICOMM Modem package is now available for the UNICORN range providing the benefits of the extensive TORCH communication packages. It offers three options: **Uniview** for viewdata services, **Uniterm** for terminal emulation, and **Unimail** which allows messages and files to be exchanged between Unimail/Torchmail/Torchmail-Plus users. Access to files can be controlled by heirarchial passwords which determine the extent of access.

Z80 Card ZEP100 with PERFECT Software Packages + Z80 Basic	£275 (a)
Z80 Disc Pack ZDP240 with software as above	£675 (a)
20Mb Hard Disc + 1×400K Floppy Drive	£1,950 (a)
UNICOMM Communications Package + modem	£161 (a)
Unicorn 68000, Unix OS/Z80B/256K, 20MB Hard Disc, 400K Floppy	£2995 (a)

ACORN Z80 2nd Processor

This processor converts your BBC into a complete business micro with all the computing power a professional would need. The system is CP/M based and is supplied with a very extensive software package. The package includes three office productivity programs, (memoplan, fileplan and graphplan), Systems generator program, three programming languages plus the ACCOUNTANT business program. Software is accompanied by extensive manuals that not only get you started but also answers your whys and hows.

All for only **£299 (a)**

ACORN 6502 2nd Processor

This processor is designed for the serious computer user who wants to get even more out of his computer. This processor provides increased memory — allowing up to 44K for Basic programs and up to 60K for assembly language programs, regardless of screen mode in use. (ideal for VIEW). An increase in speed means that programs run up to 50% faster. The second processor/BBC combination offer computing power comparable to systems costing twice as much. **£175 (a)**

TORCH GRADUATE SYSTEMS

This latest addition to the range of BBC upgrades will upgrade your BBC to a powerful 16bit business computer and make it disc & hardware compatible with the IBM PC. Its MS/DOS is customised to IBM compatibility allowing access to the massive range of IBM compatible software, programming aids, compilers and languages. It uses A8088 CPU at 5MHz, 128K or 256K ram, single or dual drive, software compatibility allows LOTUS 1-2-3, Flight Simulator and other popular IBM PC business programs to run. Connection of the Graduate is simple, with just a connection to the 1Mhz Bus. The disc drives can be used in both BBC and IBM PC mode without needing an Acorn Disc Interface in the computer. The top-of-the-market GRADUATE Model G800/2 will come complete with the superb Xchange suite of programs, comprising a full feature word processor, a financial planner, a database, and a business graphics package. Although these programs are in modular form, they can be linked together to form an integrated software system that allows you to switch instantly between various tasks and to exchange information between programs.
G800/2 **£945 (a)** Full spec & prices on application.

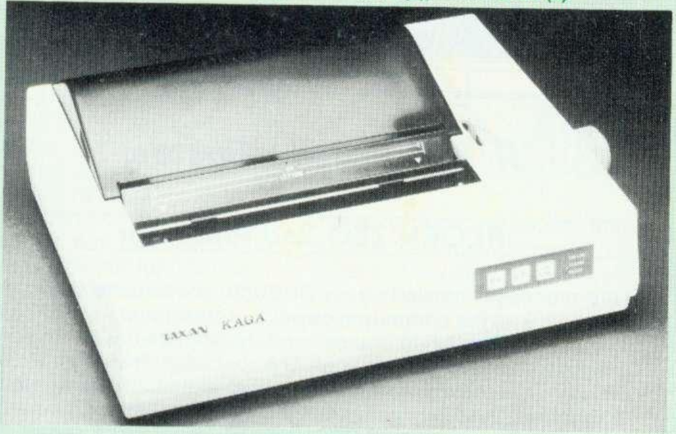
PRINTERS

ALL PRINTERS HAVE A 12 MONTH GUARANTEE

DOT MATRIX

This month we are adding the new **KAGA** printers to our range of quality dot matrix printers. These printers, with their **EPSON** compatible control codes are available in 80 col & extra wide 156 col versions. Features include NEAR LETTER QUALITY print using a 23 x 18 matrix, Dot addressable graphics in 8, 9 & 16 pin modes. Text modes include Normal, Italic, Enlarged, Condensed, Super & Sub script, Proportional spacing. Defined characters can be placed in ROM to give personalised print. An intergral 3K buffer, both friction & adjustable tractor feeds with built in paper roll holder, etc. etc. makes these superb 'value for money' printers unique.
KP810 (80 cols) **£249 (a)** KP910 (156 Cols) **£375 (a)** (With free BBC cable).

We continue to supply the ever popular, definitive **EPSON** range. This 'industry standard' range provide reliability and quality 'second to none'. The budget RX80FT Dot Matrix, has 100cps and all standard printing and graphic functions as well as friction and tractor feed. The deluxe FX80 has all the above, as well as a 160cps, buffer, programmable characters etc. For wider paper use — up to 16" — the RX/FX100 are ideal. RX80T **£225 (a)**; RX80FT **£240 (a)**; FX80 **£318 (a)**; RX100 **£345 (a)**; FX100 **£450 (a)**.



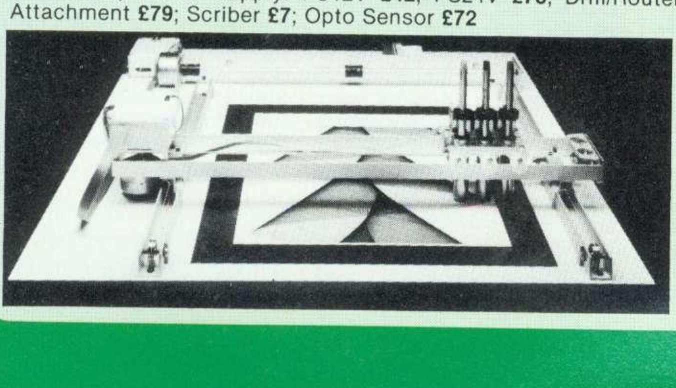
DAISY WHEEL

The Brother HR15 daisy wheel offers features normally found in printers costing far more. Features include: 14 cps, 3K buffer, proportional spacing, underlining, bold and shadow printing, two colour printing, super & subscript and many other features. Centronics parallel interface is fitted as standard.
BROTHER HR15 **£349 (a)** (With free BBC Cable).

The JUKI 6100 daisywheel with 20cps, 2K buffer, and switchable 10, 12, 15cpi + proportional printing. A linear motor ensures optimum reliability.
JUKI 6100 **£345 (a)**

GRAPHICS PLOTTER/WORK STATION

Equally at home in the artists studio, hobbyists workshop, science lab or a classroom, this system has something to offer for everyone. The 3 colour graphics plotter provides both precision and versatility. The carriage can be moved with an accuracy of 0.025cm over an A4 area — the plotter being able to accept paper and far thicker materials at sizes of up to A3. The basic plotter carries 3 colour pens each of which is software selectable. Additional accessories greatly enhance the versatility of the unit without loosing the accuracy. The servo controlled drill/router, and scriber can be used on various materials. A unique Opto Sensor (using a Hewlett Packard device) turns the plotter into a high-res scanning digitiser to read & store whole diagrams and photographs.
Workstation Complete **£490(a)**; Basic Plotter **£270(a)**; Software on disc **£3.00**; Power Supply: PS12V **£42**; PS24V **£78**; Drill/Router Attachment **£79**; Scriber **£7**; Opto Sensor **£72**



TECHNOMATIC

All prices exclude VAT

PRINTER ACCESSORIES

EPSON
Paper Roll Holder **£17 (d)** FX80 Tractor Attachment £37 (c).
Interfaces: 8143 RS232 **£35(c)**; 8148 RS232 + 2K **£55(c)**; 8132 Apple II **£60(c)**; 8165 IEEE + Cable **£65(c)**.
Serial & Parallel Interfaces with larger buffers available.
Ribbons: RX/FX/MX80 **£5.00(d)**; RX/FX/MX 100 **£10(d)**; FX80 Dustcover **£4.50 (d)**

KAGA TAXAN: RS 232 Interface + 2K buffer £85(c); Ribbon KP810/910 **£6(d)**

JUKI: RS232 Interface £65(c); Spare Daisy Wheel **£14(d)**; Ribbon **£2.50(d)** Sheet Feeder **£199(a)**; Tractor Feed Attachment **£99(a)**

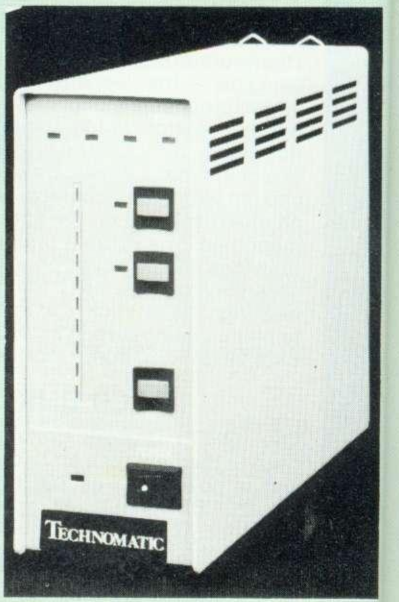
BROTHER HR15: Sheet Feeder £199(a); Ribbons Carbon or Nylon **£3(d)**

BBC Printer Lead: Parallel (42") £7(a); Serial **£7(a)**
Printer Leads can be supplied to any other length.

Plain Fanfold Paper with extra fine perforation (Clean Edge):
2000 9.5" × 11" £13(b); 200 15" × 11" **£18.50(b)**
Labels: 2-3/4" × 1-7/16" in quantities of 1000
Single Row: £5.25/1000 (d); Triple Row: **£5.00**/1000 (d)

PRINTER SHARER BUFFER

A unique delux printer buffer/sharer providing a simple way to upgrade your computer system by allowing greater utilisation of existing equipment by reducing the waiting time for printing documents. Data from three computers can be loaded into the buffer which will continue accepting data until its 64K storage is full. The buffer will automatically switch from one computer to the next as soon as that computer has dumped all its data. The computer is then available for other uses. A LED bargraph indicates the memory usage, with LED indication showing from which computer the data is being fed from. There is simple push button control for PAUSE, RESET, and COPY facilities. The copy facility is ideal for continually printing copies of a document without 'tying up' the computer. Built in mains psu.
SP110 BUFFER/SHARER incl one cable set **£275(b)**



PRINTER SHARER

Three Computers to one printer (parallel)........**£65(b)**
Six Computers to One Printer (parallel)......**£129(b)**
Cables for Three Way Sharer........**£25(c)**
Cables for Six Way Sharer........**£38(c)**

COMPUTER SHARER

Two Printers to one Computer........**£19(c)**

GRAFPAD

A low cost graphic tablet offering the performance & durability required by industrial and educational users. It is compact, accurate & reliable; working area 240 × 192mm + menu area. Comes complete with a CAD packag. **£120** (b). 'Microdraw' CAD Package **£21.70** (d).

VIEW PRINTER DRIVER FOR FX80/KP810

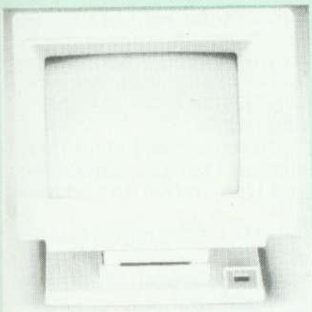
This driver allows the use of all FX80s fonts to be used in text written using the VIEW rom. If user defined characters are held in the printer buffer they can also be used within the text. Manual includes examples. Supplied on 40 or 80 Track disc........**£7 (d)**.

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Please add carriage: (a) £8; (b) £2.50; (c) £1.50; (d) £1.

MONITORS

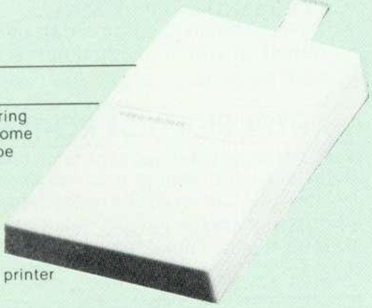
A choice of high quality RGB and Monochrome monitors are available. The British made **MICROVITEC** Std/Med/Hi Resolution 14″ monitors offer a consistent reliable performance. Their resolution ranges from 452 pixels horizontal on the std res monitor to 895 pixels on the Hi res monitor. Std res monitors are also available with RGB/PAL/Audio inputs. Dual input versions also available.
1431 Std. Res. RGB £175 (a); 1431AP RGB/PAL/AUDIO £225 (a);
1451 Med. Res. RGB £295 (a); 1441 Hi-res RGB £420 (a).
2031 20″ Std. Res. RGB £260 (a).
Plinth for Microvitec 14″ Monitors £8.50 (c).
The **KAGA** Vision 3 12″ RGB monitor offers a superb performance but in a smaller cabinet with a genuine etched anti-glare screen. **£358** (d).
The Japanese made **SANYO** and the **KAGA** monochrome monitors provide an ideal answer for an 80 character hi-clarity display. A futuristic swivel base plinth with integral clock is available for the Kaga green monitor as an optional extra.



KX1201G with stand

SANYO DM 8112CX Hi Res Green Screen....................................£99 (a)
KAGA KX1201G 20MHz Hi Res Green with etched screen....£106 (a)
Swivel Base for Kaga Green (fitted with digital clock)..............£22.50 (c)
Note: All monitors are supplied with free BBC leads.
BBC Leads: Kaga RGB £5; Microvitec £3.50; Monochrome £3.50 (d)

VIDEO DIGITISER



A high quality yet cost-effective unit offering uses for the scientific, educational and home user. Feeding in a video signal (this can be from a camera, VCR etc) will output to the BBC a high quality picture, with eight different grey levels. This picture can be stored on disc, manipulated or dumped to a printer. The friendly, yet sophisticated menu driven software comes complete with an Epson printer dump. £250 (a).

SANYO DR101 DATA RECORDER

A high quality tape recorder with circuitry specifically designed for data recording. Having normal as well as data recording, as well as cue/review and a tape counter, it makes this recorder an ideal choice for anyone wanting a reliable tape storage device. **£30** (c). Cassette £3.00 (d).

ACORN ANFO3 TAPE RECORDER

The official Acorn tape recorder recommended for the BBC. Has a counter, automatic record level, mains/battery and comes complete with a BBC cassette cable..£28.50 (c).

RH LIGHTPEN

A superior quality lightpen, features including: adjustable sensitivity, LED output to show data transmission, microswitch tip. Full software backup. £39 (c). The 'Lightpen Colour Graphic Software' pack helps you to draw line drawings as well as more complex drawings. Colour fill, point plotting, line, square, triangle, circle XY rulers are all available with rubber banding facility. £7 cassette, £9 Disc. The 'Artfun' pack provides full interaction between pen and screen. Allows your initial design to be shrunk into a high res format, and these images can be stored for subsequent use. £7 cassette. The 'Word Master' encourages the use of correct grammar and is an excellent aid. £7 on cassette. The 'Ed Master' uses a quiz format, and up to 160 questions may be programmed by the teacher. £7 on cassette (d).

DISC DRIVES



Technomatic Disc Drives offer the best value for money. They come fitted with high quality slimline Japanese mechanisms & represent the state of art in disc drive technology. They are built to highest standards in design and production, and are all tested to their full performance capability before packaging. All drives are available with or without integral power supply. Dual Drives with PSU are supplied with generously rated integral switched mode power supplies. All 80 track TEAC drives are fitted with 40/80 Track switching at no extra charge to the user. Attractively designed steel casings are painted in hard wearing BBC matching beige paint. All drives can operate in single or double density modes. Drives are supplied complete with necessary cables, manual and formatting disc and are ready to be connected to the computer.

Single Drives
100K 40T SS TEAC £100(a); TEC with psu £135(a)
200K 80T SS 40/80T TEAC £155(a) TEC with psu £165(a)
400K 80T DS 40/80T TEAC £185(a) Mitsubishi with psu £195(a)
3″ 100K HITACHI Drive £115(a)
Dual Drives
2 × 100K 40T SS with psu: TEAC £300(a) TEC without psu £225(a)
2 × 200K 80T SS with psu 40/80T TEAC £375(a) TEC without psu £275(a)
2 × 400K 80T DS with psu 40/80T TEAC £400(a) Mitsubishi without psu £325(a)
2 × 400K 80T DS with psu Mitsubishi £400(a).

Our 40/80 Track Switching Module will take care of your frustration of not being able to read or write 40 Track software on 80 Track drives. No additional cables or accessories needed. Full fitting instructions supplied. All for only £30 (c).

The FLOPPICLENE disc head cleaning kit is the ideal way to ensure the optimum performance of your drives. The use of disposable cleaning discs eliminate the risk of recontamination and abrasion of the sensitive disc heads and ensure continuously reliable data capture and transmission.
Floppiclene with 20 disposable cleaning discs. £14.50 (b)

OFFER

SCOTCH 3M DISCS

OFFER

This month we are offering these high performance discs at a bumper bargain price — not to be repeated again. The current offer will be valid for orders received until 15th October only. These discs are manufactured with advanced manufacturing techniques that have enabled 3M to set the industry standard. Their quality is such that their error free performance is guaranteed for life.
Discs in pack of 10 (c): 40T SSDD **£12.50(c)**; 40T DSDD **£17(c)**; 80T SSDD **£21(c)**; 80T DSDD **£22(c)**

DISC ACCESSORIES

Single Disc Cable £6 (d) Dual Disc Cable £8.50 (d)
10 Disc Library Case £1.90 (d) 30 Disc Case £8.00 (c)
Lockable Storage Boxes: 30/40 Discs £14 (c) 70/80 Discs £18 (c)

KENDA DMFS

This is an alternative to the Acorn DFS with several significant advantages. *Single/Double Density *Up to 379 Files per disc. *No user ram required i.e. PAGE = &EOO *CP/M compatible file structure *Can read DFS files *Can read most Acorn and other protected software. Simple plug-in installation — comes complete with utilities disc and manual..£120 (c)

MODEMS

We stock a modem for every requirement, whether it is for the business, or private user, whether you require access to a public database or a mainframe, whether for local or international use. We also carry suitable software — see our section on ROMS.

TORCH UNICOMM

See our section on Torch for further details.

ACORN PRESTEL

The dedicated Prestel adaptor complete with integral, BT approved, auto-dial modem and software in ROM £99(a).

BUZZ BOX

A full spec, BT approved, pocket size, direct connect modem with both originate & answer modes, full & half duplex, allowing access to many databases, bulletin-boards as well as intercomputer communications. It conforms to CCITT V21 300/300 Baud standard. Battery/mains powered. **£65**(c) BBC Lead £3.50 External PSU £8.

WS2000

A world standard direct connect modem switchable between 75,300/300,600,1200/75,75/1200 baud, awaiting BT approval. It is compatible with Bell 103/113/108, 202 and CCITT V21 & 23 standards and allows you to communicate with virtually any computer system in the world. This is one of the new generation modems, that will probably cover any communications standards you would ever need. This is the modem that will cover



Prestel, Micronet, Telecom Gold, Distel, Microweb, One-to-One, Bulletin Boards both in the UK and abroad, etc. etc. as well as user-to-user communication. It also has a rather useful facility of 'Reverse-Prestel' mode i.e. 75/1200 so that you can communicate with other users who only have a standard 1200/75 type modem. What possibly gives this modem its biggest advantage *is its option* of computer controlled switching between all modes of operation. In addition, separate auto-answer and auto-dial cards are available, *giving this modem possibly the greatest potential of all.* Mains powered. £129(c).
Please phone/write for details of optional extras.

TELEMOD-2

A BT approved modem complying with CCITT V23 1200/75 Duplex & 1200/1200 Half-Duplex standard, that allows communication with Viewdata services e.g. Prestel, Micronet etc., as well as using 1200 Baud for communicating with other computer users. Mains powered. TELEMOD 2 **£65**(b) BBC Lead £3.50

ACORN IEEE INTERFACE

This interface enables a BBC computer to control any scientific and technical equipment that conforms to the IEEE488 standard, at a lower price than other systems, but without sacrificing any aspect of the standard. The interface can link up to 14 separate IEEE compatible devices. Typical applications are in experimental work in academic and industrial laboratories, with the advantage of speed, accuracy and repeatability. The interface is mains powered and comes with cables, IEEEFS ROM, and user guide. £282(a)

ACORN TELETEXT INTERFACE

This interface enables a BBC Computer to receive and store teletext information transmitted by both BBC and ITV. In addition it allows the downloading of transmitted software. The unit comes with a ROM and user guide. £195(b)

TECHNOMATIC

All prices exclude VAT

EPROMER II

Our current version of the highly popular Eprom programmer is now being enhanced to provide more and better facilities for easy programming by the user. The software will maintain its superiority over all currently available similar programmers. The range of eproms handled has been widened to include the eproms with lower programming voltage and eproms which can be programmed using the fast algorithm. Control of all operations has been moved to the keyboard. The screen display has been improved to give more information. The screen editing facilities have also been modified to simplify the data entry.

Preliminary Information

* The new Eprom Programmer will now program 2516, 2532, 2564, 2716, 2732, 2764, 27128 and 27256 + 5v eproms, and all but the 27256 in a single pass.
* The programmer will be supplied with integral power supply, and interfaces with the BBC via the 1MHz bus. It is fully buffered and complies with Acorn protocols. There is no power drain from the computer.
* No knobs or switches to fiddle with — total control from the keyboard.
* Fully software driven with easy to understand instructions displayed on the screen.
* Eprom type selectable from the keyboard.
* Selectable programming voltage 25/21/12.5V.
* Defaults to normal programming with high speed algorithmic programming selectable, for a device with suitable capability.
* Continuous screen display of eprom type, option and address range selected.
* Full screen editor with HEX or ASCII input. Constant display of logical eprom address.
* Can read, blank check, program and verify at any address/addresses on the eprom.
* Full Tape/Disc filing facility.
* Several basic programs can be entered on a single eprom and called up with individual name.

ATPL SIDEWISE ROM EXPANSION BOARD

This is a well constructed expansion board that does not require soldering in its installation. It will give you an additional twelve sockets, with a 16K batter-backed RAM option. All the busses are fully buffered. **£39(d).**

EPROMS 8K 2764-25 £6.50(d); 16K 27128-30 £21.00(d).
RAM 8K standard power 6264-15 £35; 8K low power 6264LP-15 £41.00.

SMARTMOUTH

The Original 'Infinite Speech' Synthesiser — Still the Best!
A ready-built totally self-contained speech synthesiser unit, attractively packaged with built in speaker, Aux. output socket etc. Optimum sound quality is achieved due to a tailored frequency response audio stage. It allows the creation of any English word with both ease and simplicity, while, at the same time, being very economical in memory usage. You can easily add speech to most existing programs. Due to its remarkable infinite vocabulary, its uses spread throughout the whole spectrum of computer applications — these include educational, industrial, scientific, recreational etc. — simply plugs into the User Port. No ROMs are needed. Smartmouth is supplied with demo and development programs on cassette and full instructions. £37(c).

UV ERASERS

UVIT with built-in timer and safety switch £59(b).

'TIME-WARP' REAL-TIME CLOCK CALENDER

A low-cost compact unit that opens up the total range of Real-Time applications, and adds a new dimension to the personal computer. Though built to exacting professional standards, it is at a price previously unattainable, and brings it within reach of all BBC Computer owners. With its full integral battery backup, possibilites include an Electronic Diary, continuous display of 'on-screen' time and date information, automatic document dating, precise timing and control in scientific applications, recreational use in games etc. — its uses are endless and are simply limited by ones imagination. Simply plugs into the User Port — no ROMs needed. Extensive applications software supplied on cassette (easily transferred to disc) and full instruction manual. Please phone for details. £29(c).



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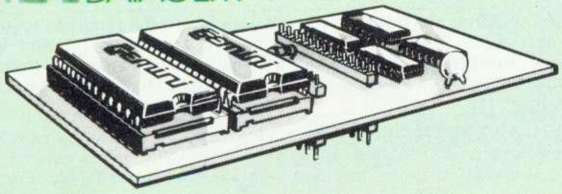
COMMUNICATION ROMS

TERMI This is a semi intelligent terminal emulator allowing the BBC to act as a dumb terminal, slave BBC graphics terminal, or VT52 terminal. The rates at which data is sent or received is easily set up with rates of up to 4800 Baud with 40/80 col. selectable. Allows files to be transmitted from disc, or a copy of incoming data to be sent to a file or to a printer. (Termi is not suitable for PRESTEL). **£28(d).**

COMMUNICATOR This is a full 80 col VT100 terminal emulation program on 16K eprom. It is a more advance program than TERMI and features easy to follow screen menus. The rate at which data is sent or received is easily set up with rates up to 19200 Baud with 80 column text. Allows files to be transmitted from disc, or a copy of incoming data to be sent to a file or to a printer. (Communicator is not suitable for PRESTEL). **£59(d).**

COMMSTAR This intelligent communication facility is extremely easy to use yet very versatile. It features a terminal mode, a full VT100 emulation mode and a special PRESTEL mode. In Terminal mode, all input may be copied into a buffer in memory over which full control is provided. Controls of protocols is very simple and any type of file (not just ASCII) may be sent using XModem protocols. The Emulation mode may be used using a disc based emulation file to emulate virtually any terminal type including VT100, within the capabilities of the BBC. In PRESTEL mode all normal Prestel features are available, including downloading of software, saving and retrieving of pages etc. etc. **£29(d)**

Gemini DATAGEM



The Definitive Random Access, 24K ROM Based DATABASE MANAGEMENT SYSTEM.
Datagem is the first truly flexible database for the BBC Micro that can make your system really useful and efficient, saving you money in the long run. The system includes a carrier board containing two Eproms, demonstration applications disc in both 40/80T, professional documentation with quick reference card, and 'Trans' utility program. Features include: *almost unlimited file size (max 10MByte) *supports up to 4 drives *Max of 5000 records per file *max 6K record size *max of 62 fields *9 level hierarchical search system with facilities to store results of searches. Searches can be any one of the following: Search, Include, Exclude, Combine, Common or Difference *user defined variables *generates form letters from records. Please ask for leaflet. **£112(c).**

ACORNSOFT/MIRLE Business software

Using this well designed, cost effective business system, the small businessman is able to reduce repetitive tasks significantly, and increase efficiency at the same time. Instead of making individual entries in stock records, VAT records, purchase records, sales records, and so on, the entry is made just once. As well as taking care of the production of all the paperwork, the system also allows for instant access to information and speedy analysis of recorded data. The beauty of the system is that packages can be purchased and used individually with the option of, possibly later, linking them with the other packages.
Invoicing: Stores details such as names & addresses of customers, products, VAT numbers, etc. **Order Processing:** You can confirm your customers orders, check on their requirements, prepare despatch notes, and get speedy order analysis of single orders, selected orders, or all the orders stored on the data disc. **Accounts Receivable:** Provides accurate maintenance of customer accounts, and instant access to customer account status. **Accounts Payable:** Provides accurate maintenance of supplier accounts, and instant access to supplier account status. **Stock Control:** allows you to keep an eye on product records, record stock receipts and issues, report on restocking requirements and to analyse stock for valuation and physical reconcilliation as well as instant access to stock status and automatic analysis of stock by quantity and value. **Purchasing:** All names and addresses of suppliers can be retrieved instantly for the production and printing of orders. **Mailing System:** When sending a mailshot, you can specify criteria such as size of company, location, type of industry, value of business etc. Will print names and addresses on either gummed labels or printed paper. **£22(d).**

BBC FIRMWARE

VIEW **Word Processor Rom on special offer at £48(c).**
This is the new version V2.1. Advantages include being able to print straight from memory, as well as editing in any mode. Complete with comprehensive manuals to Acorns usual high standard.

WORDWISE One of the most popular word processors for general use **£34(d).** Wordwise SpellCheck Disc — A must for any serious word processor user. Normal price **£16.50(d).** If bought with Wordwise: No p&p and only **£14.**

ULTRACALC From BBC Publications: The only spreadsheet ROM for the BBC that offers features found in the most sophisticated spreadsheet programs, like the handling of labels as well as numbers as values, and allowing a search by a meaningfull name instead of just a number etc. Efficient memory usage allows large spread sheets to be constructed. Facilities and commands include, variable width column, Sum, Replicate, Insert, Delete, & most mathematical functions. It helps to create and manipulate pricelists, balance sheets, payroll, c/flow forecasts, order entry, small databases, scientific calculations. **£69(c).**

BCPL A full implementation of the BCPL compiler language from Acornsoft. It consists of the BCPL language ROM and a disc containing the BCPL Compiler, a Screen Editor, a 6502 Assembler, other utilities and program development aids, and some examples of BCPL code. A comprehensive 450 page user guide is included. It can be used to develop games programs and commerical packages, to develop system software, to write control systems, and to produce programs which otherwise would need to be written in assembler. **£86(b).**
BCPL CALCULATIONS PACKAGE: supplied on disc, it supports floating point, fixed point and fast integer calculations. It includes the BCPL calculation files, example files and a comprehensive user guide. **£17.30(b).**

UTILITY ROMS

DISC DOCTOR This general purpose ROM adds 20 commands to the DFS system. It includes a formatter, sector editor, tape-disc & disc-tape routines, a powerful disassembler, commands for listing function key definitions for editing etc. This ROM will obliviate the need to go for non standard DFS systems (with their inherent disadvantages) as it overcomes many of the Acorn DFS's shortcomings. **£28(d).**

GREMLIN Contains a full machine code monitor including features such as a dissassembler, memory move and search routines. Also feature a full expression evaluator and an assembler. Can single step through ROM & RAM as well as any sideways ROM. Works in any mode with full status display. Up to 8 breakpoints can be used and it has a special mode for debugging graphic programs. **£28(d).**

EXMON This extended machine code editor provides 35 new commands. Features include machine code relocator, single stepping, memory search and full assembler & dissassembler. **£20(d).**

TOOLKIT This ROM adds 27 new commands to the BBC BASIC. These include a full screen editor, merge, relocating data in memory, program compactor, listing of variables and memory search. **£23(d).**

CARETAKER This adds 17 new commands to the BASIC which include: renumber, squash, exchange insert, single key entry of BASIC keywords etc. **£28(d).**

GRAPHICS ROM This ROM includes over 28 new graphics related commands which can be used in BASIC programs. Features include: sprites, LOGO Turtle graphics, fill routines, shading, large characters, rotation, scaling and 3D plotting all using '*' commands. **£28(d).**

PRINTMASTER This ROM features the most versatile screen dump for EPSON MX/RX/FX80 and Kaga 810 printers. It supports three types of dumps. The first allows any graphics on the screen to be dumped. Colours appear as shades of grey. Any part of the screen can be printed at any position on the paper in any one of four orientations. The screen dump may be magnified by any factor ×2, ×3, ×4 etc. A special feature allows true MODE 7 screen dumps with TELETEXT text & graphics. The second dump allows any text to be dumped whilst the third dump will print the contents of a file on disc whilst the computer is doing other things. This is not all. All printer functions can be called up using the *command. *DEFINE allows the user to define his own characters and store them. *GPRINT allows printing of enlarged text in any position, orientation, size & shade. *WINDOW allows windows to be defined in any size and position on the screen. In short this one ROM does it all. **£28(d).**

SOFTWARE

TURTLE GRAPHICS

Ideal as an introductory package for teaching geometry, mathematics and graphics at an elementary level. **£17.30 on disk.**

MICROTEXT

This authoring system was developed by the National Physical Laboratories. It is a programming system designed to simplify the production of a wide range of man-computer dialogues. Using Microtext's simple commands, the user can draw up any number of 'frames', each containing text and/or graphics. A series of frames build up into a complete module. Each program can consist of more than one module. Using Microtext, an expert in any field can construct their own complete courses of computer-based instructional material. Applications include interviewing systems, teaching packages, training courses and interactive demonstrations and simulations. Available on Cassette and Disc. **£52(a) Disc; £43(c) Cassette.**

S-PASCAL

Contains a subset of Pascal — one of the most popular programming languages available today. The package contains the S-Pascal compiler on disc, several example programs and a comprehensive user guide. **£17.30(d)**

ACORN LISP

Lisp provides more flexibility in data and control structures than traditional languages. Is easy to learn, and is widely used for writing substantial and sophisticated programs, with practical applications. **£17.30(d) Disc; £14.35(d) Cassette.**

ACORN FORTH

Forth is a compiled language, so programs run very fast (typically five times faster than Basic). **£17.30(d) Disc; £14.35(d) Cassette**

DESIGN

Design is a screen processor which allows information to be displayed in a format suitable for demonstrations, slide projections, handouts or presentations. **£16.50(d) Disc; £8.50(d) Cassette.**

SUPERPLOT

Superplot is ideal for anyone interested in screen representations of mathematical functions. **£16.50(d) Disc; £8.50(d) Cassette.**

SPELLCHECK

The spelling checker available for both Wordwise and View. **£16.50(d) Disc; £8.50(d) Cassette each.**

MASTERFILE

A general purpose data base that is extremely useful, allowing vast amounts of information to be stored. The disc version allows up to 17 fields per record, and the only limitation as to the number of records, is the capacity of the disc. Typically, using 5 fields, about 2000 records may be stored on a 100K disc. **£16.50(d) Disc.**

PAINTBOX

A joystick drawing program for the BBC, You can use it to doodle or to design sophisticated full colour pictures. **£8.50(d) Cassette.**

VU-Type This is a powerful and versatile typing tutor developed and published in association with Pitmans. It is designed to enable you to acquire or enhance typing and keyboard skills. **£12(d).**

Record Keeper A personalised program for storing and retrieving data for a variety of purposes. Report facility lets you choose how to generate the layout of your data and display and print it. The program also contains alternative versions for transfer to disc. **£16.50(d).**

BOOKS

(No VAT p&p £1.50 per book)

Let your BBC Teach U To Program........£3.50
100 Programs for the BBC........£6.95
30 Hour Basic........£6.95
35 Educational Progs........£6.95
6502 Applications........£10.95
6502 Assembly Lang Programming........£13.95
6502 M/Code for Beginners........££5.95
6522 VIA Book........£4.50
6809 Assembly Lang Programming........£13.95
Advanced Graphics with BBC........£9.95
Advanced M/C for the BBC........£7.95
Advanced Prog Tech for BBC........£8.95
Advanced 6502........£11.75
Advanced User Guide........£12.50
Assembly Lang Prog on the BBC........£8.95
Assembly Lang for the BBC........£8.95
Assembly Lang Prog for Electron........£26.00
Assembly Lang Programming Birnbaum........£8.95
Basic Prog on the BBC Cryer........£5.95
Basic Rom User Guide........£7.95
Basic II Rom User Guide........£4.00
BBC Basic........£5;95
BBC Basic for Beginners........£6.95
BBC Micro for Beginners........£6.95
BBC Micro Disk Companion........£7.95
BBC Micro Expert Guide........£6.95
BBC Micro Graphics & Sound........£7.95
BBC Micro in Education........£6.50
BBC Micro Revealed........£3.50
BCPL User Manual........£15.00
Beyond Basic........£7.25
Creating Adventure Progs........£6.95
Creative Graphics........£7.50
DIY Robotics & Sensors........£6.95
Disc Book........£3.50
Disc Systems........£6.95
Discovering BBC M/Code........£6.95
Essential Maths BBC/Electron........£5.95
Forth........£7.50
Friendly Computer Book........£6.95
Graphics on the BBC Micro........£6.95
Graphs & Charts........£7.50
Interfacing the 6502........£10.95
Intro BBC Micro........£5.95
LISP........£7.50
Making Music on the BBC Computer........£5.95
Micro BBC Basic Sound Graphics........£7.95
MOS Memory Data Book........£3.95
Prog the BBC Micro........£6.95
Programming the 6502........£10,95
Programming the 6809........£11.95
Programming the 8086/8088........£11.75
Programming the BBC........£6.95
Programming the Z80........£13.45
Start Prog with Electron........£5.00
Step by Step Prog Book 2........£5.95
Structured Programming........£6.50
The Electron Book........£5.00
TORCH Z80 Disc Pack User Guide........£10.00
TTL Data Book Vol-1........£9.00
TTL Data Book Vol-2........£8.20
BBC User Guide........£15.00
Using BBC Basic........£10.00
Using Floppy Disks........£6.95
Using the 6502 Assembly Lang........£14.50
Z80 Applications Book........£13.45

EDUCATIONAL PROGRAMMES

A selected range of cassette based software for all the family to enjoy and at the same time arouse curiosity and create an interest in computers. Apart from providing hours of fun they will also help teach the young ones fundamentals of English and Maths without them realising it.

Mr T's Alphabet Games Watch how quickly the children learn to identify, name & match the letters and also write them correctly. Amusing sound effects and animated graphics make learning fun. **£7(d).**

Number Gulper A gripping fast moving game that helps develop arithmetic skills. 19 levels of skill to cater for all ability levels. Even parents might find upper levels embarassing. **£7(d).**

Words Words Words A stimulating game to help young children with reading & spelling. Pictures are shown on the screen and the child has to type in the name of the object shown. If correct, the object takes its place in a scene. When all objects have been correctly identified the scene comes to life. **£7(d).**

Tree of Knowledge A interactive program that teaches categorisation. The computer is first educated about a group of objects — e.g. plants or birds. The database, or tree created in this way is then used in playing a guessing game. Two sample databases are supplied on the program. New databases are saved and loaded from within the programs. **£7(d).**

Royal Quiz Pit your knowledge of Royalty against Anthony Holden, the Royal Biographer. Do you know who told the queen that she didn't recognise her "without her crown on"? The quiz will tease, teach and entertain. **£7(d).**

Science Fiction Quiz A SF quiz in the widest sense, especially adapted from the Weidenfeld Quiz book that will provide hours of edification and amusement. **£7(d).**

TECHNOMATIC SERVICE

Our in depth stocks allow us to offer immediate deliveries on most items and our aim is to provide the best available products at competitive prices. In addition to the items listed above we carry extensive stocks of: connectors, connector assemblies, components including TTLs, CMOS, RAMS, EPROMs and CPUs. Spares for the BBC computers are normally available from stock. Orders from government departments, public bodies, hospitals, schools, colleges, universities and recognised PLCs welcome. We specialise in world wide exports. No VAT on exports. Our specially negotiated freight charges to many countries ensure the customer considerable savings on charges.

TECHNOMATIC LTD

MAIL ORDERS TO: 17 Burnley Road, London NW10 4ED
(Tel: 01-208 1177 Telex 922800)
SHOPS AT: NW London: 15 Burnley Road, London NW10 4ED
(Dollis Hill 2 mins walk, ample car parking space)
West London: 305 Edgware Road, London W2. Tel: 01-723 0233
(Near Edgware Road)

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LIFE, THE UNIVERSE AND MY BEEB

Astronomer Chandra Wickramasinghe and his micro pursue a theory of organisms in space



Courtesy Hale Observatories

Figure 1. The Trifid nebula in the constellation of Sagittarius

COMPUTERS are now vital to space science and astronomy: first collecting information from space probes and satellite-borne telescopes, and then analysing and interpreting the results. Micros have also played a role, especially when linked to equipment launched in rockets.

However, I have a more personal story of working with micros. My research into the origins and evolution of life in the Universe is aided and abetted by my own BBC model B with Cumana disc drive, PL digitiser, Epson FX80 printer and Tandy graph plotter. It might seem an amateurish medley of equipment, but I found it better in some ways than a university mainframe computer!

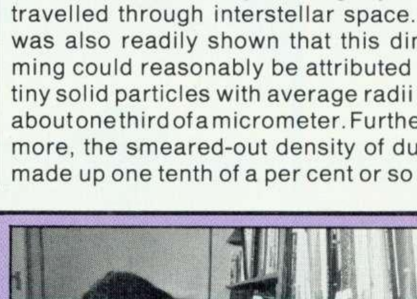
My tale begins with the Lagoon and Trifid nebulae in the constellation of Sagittarius (figure 1). Here is a rich field of stars in a portion of the Milky Way, containing in addition to stars, clouds of hot glowing gas, with dark patches and striations silhouetted against a brighter background. The dark patches represent clouds of obscuring dusty material found in many galaxies and known to astronomers as "interstellar fogs".

Matter exists within these clouds in a variety of forms: single atoms, ions, molecules and, perhaps the most baffling component of all, 'dust'. These dust particles have radii in the range 1/100 to 1/3 of a micrometer and their space density by earthly standards is exceedingly low – the average distance between them is as much as 100 metres! Despite the tenuous nature of the clouds, their size – light years across – is so vast as to produce the fog patches shown in figure 1.

Light from distant stars in our galaxy is dimmed and reddened by scattering and absorption effects in interstellar dust particles. The effect is similar to the dimming of a street light seen through a fog, caused by the water droplets scattering the beam of light. Since the 1930s, a succession of attempts have been made to determine in a quantitative way the dimming – or extinction, as it is called – of starlight due to cosmic dust. In fact, the intensity of visual starlight is reduced by a factor of about 100 for every 3000 light years travelled through interstellar space. It was also readily shown that this dimming could reasonably be attributed to tiny solid particles with average radii of about one third of a micrometer. Furthermore, the smeared-out density of dust made up one tenth of a per cent or so of

Astronomer in action

The author is an internationally renowned astronomer; a collaborator with Professor Sir Fred Hoyle, and co-author with him of books such as 'Lifecloud', 'Diseases from Space' and 'Evolution from Space'. Their latest book, entitled 'From Grains to Bacteria', is due to be published this month by the University College Cardiff Press.



all the stellar and non-stellar material in the immediate vicinity of the Sun.

Data on interstellar dust is being steadily added to from observations made by satellites such as the International Ultraviolet Explorer and IRAS. Much of the information has accumulated over the past two decades, and it was at the start of this period that my own work with Sir Fred Hoyle began. We set out in 1962 to find a composition of cosmic dust that could explain the available data, and we have continued in this endeavour unceasingly ever since. We first explored the possibility that the dust in space might have an icy composition, but had no success at all. Then we discussed the possibility of carbon dust grains and carbon grains overlaid with icy mantles. Here we had a limited measure of success in that observations using the latest satellites and rockets proved that at least a fraction of the dust in space was made of carbon in the form of graphite. Next we considered mineral grains and mixtures of minerals with graphite in attempts to match the full range of observational data, but woefully without luck. The precise composition of the interstellar dust stubbornly defied identification for 10 years.

Then, in 1973, we considered the possibility that cosmic dust had a predominantly organic composition. This model instantly led to a better – but not perfect – agreement with observational data than for purely inorganic grains. However, we felt that at long last we were approaching the correct solution. Then in 1979 a major breakthrough occurred. Sir Fred Hoyle and I considered the seemingly outlandish proposition that the cosmic dust grains were not merely organic, but biological; live, freeze-dried bacteria in space.

Within days of arriving at this heresy, a mathematical calculation was carried out on a BBC micro to determine the way in which such particles cause the dimming of starlight. The computation involved a solution of the well-known Maxwell's equations with the boundary conditions for spheres having the properties of biological particles. The BBC's highly versatile Basic language made this calculation relatively easy, and the resulting graphs were plotted on the Tandy plotter-printer. The calculated curve of the microbial model agreed almost precisely with the astronomical data (figure 2). This agreement, coming after almost two decades of failure, gave us confidence to embark further in the direction of cosmic microbiology.

Together with Mr S Al-Mufti and Dr A H Olavesen, Sir Fred Hoyle and I next set up a program of laboratory studies to look for diagnostic thumbprints of

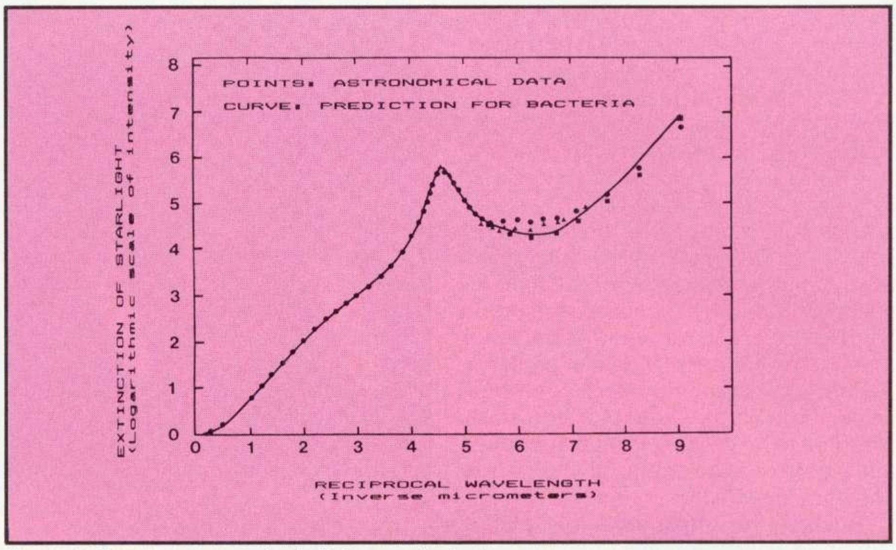


Figure 2. The dimming of starlight by cosmic dust

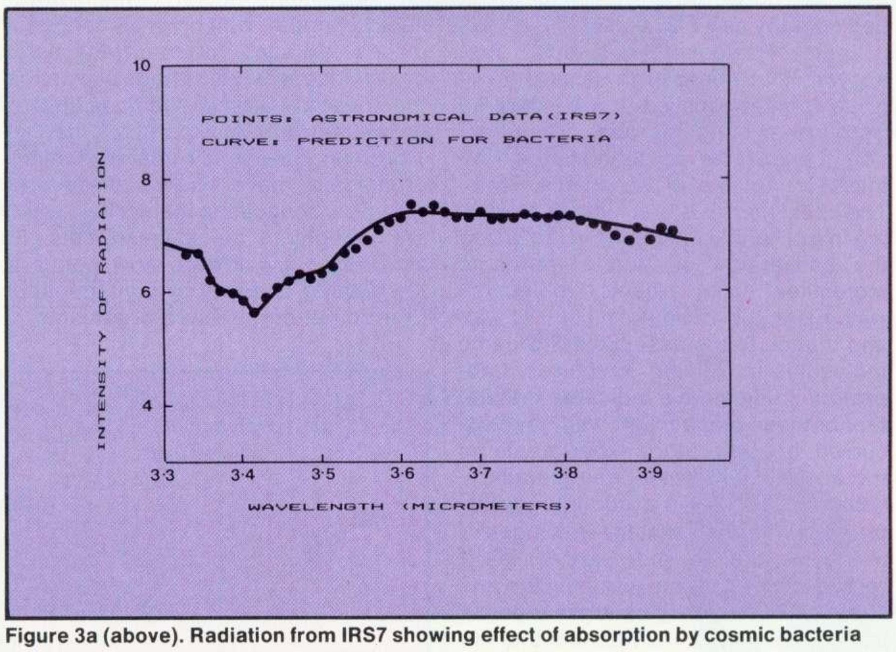
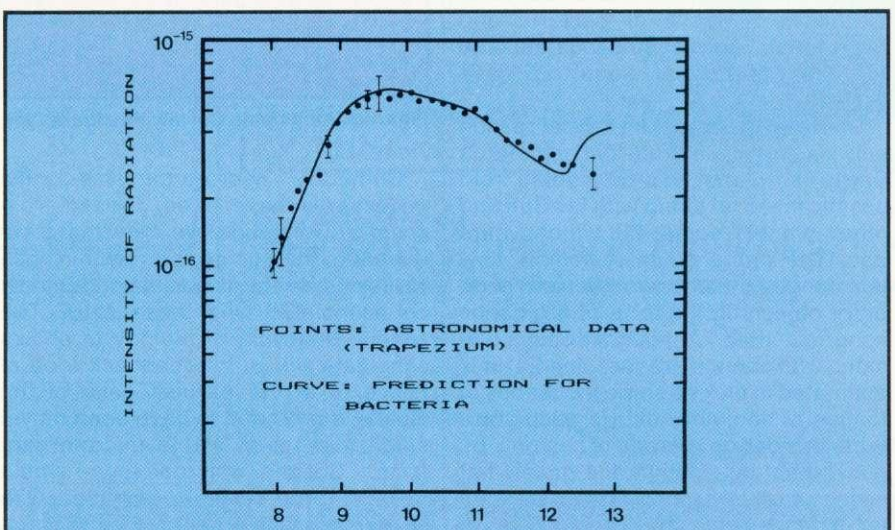


Figure 3a (above). Radiation from IRS7 showing effect of absorption by cosmic bacteria

Figure 3b (below). Radiation from hot bacteria in the Trapezium nebula in the constellation of Orion



biology at infra-red wavelengths. An infra-red spectrum of a dried out micro-organism over the waveband 2.9-5.5micrometers was compared using the digitiser with data for the infra-red source IRS7 located near the centre of our galaxy. The result, shown in figure 3, was plotted on the Tandy. Figure 4 shows a comparison between the biological model and astronomical data over another waveband, 8-12micrometers. The correspondences seen in figures 2-4 are in our view decisive for the identification of cosmic bacteria. Bacteria resembling terrestrial bacteria, but in a freeze-dried state, seemed to be present in vast quantities on a galaxy-wide scale, giving rise to the dark fog effects.

But how, you might ask, could such a situation arise, and how does this connect with other facts from astronomy and geology as well as biology?

Louis Pasteur (1822–1895) first showed that micro-organisms did not arise spontaneously, but were derived from pre-existing microbes. The question then arises as to how the first micro-organisms arose on the Earth. The usual theory is that flashes of lighting in a primitive atmosphere led first to the conversion of simple inorganic molecules into organic molecules which are the building blocks of life, and thence to the assembly of organic molecules into living structures. Laboratory studies have indicated that the first of these steps might well have occurred, but laboratory experiments on the second step have been singularly without success. An argument against the usual theory is that the first signs of microbial life in the Earth's fossil record occur far too abruptly for any chemical evolution to have preceded it. In fact, at the very first moment that life could have survived on Earth, about 3.8 billion years ago, we find evidence of microscopic fossils of bacteria and microfungi. There seems too little time for any 'primordial soup' to have brewed.

There is, of course, no logical reason why life should have started *de novo* on Earth. Our planet was assembled from cosmic material along with the Sun and other planets some 4.6 billion years ago. The entire solar system is now surrounded by tens of millions of cometary objects in the form of a gigantic spherical halo. Although direct collisions with comets are rare, the Earth is estimated to pick up some thousands of tonnes of cometary debris each year. What this debris is made of can only be guessed at by studying the gases that escape from the comet head as seen for instance in the fan-like structures of figure 4. Sir Fred Hoyle and I have argued that comets are in fact chock-a-block with cosmic micro-organisms, and that their nuclei contain warm liquid ponds which are congenial places for such micro-organisms to breed. Indeed, studies have shown that the overall atomic composition of comet material is remarkably life-like. Moreover, fossilised remains of micro-organisms have been discovered within carbonaceous meteorites, which are thought to be spent comets. So astronomical evidence now points to life starting on Earth by contamination from comet-borne micro-organisms.

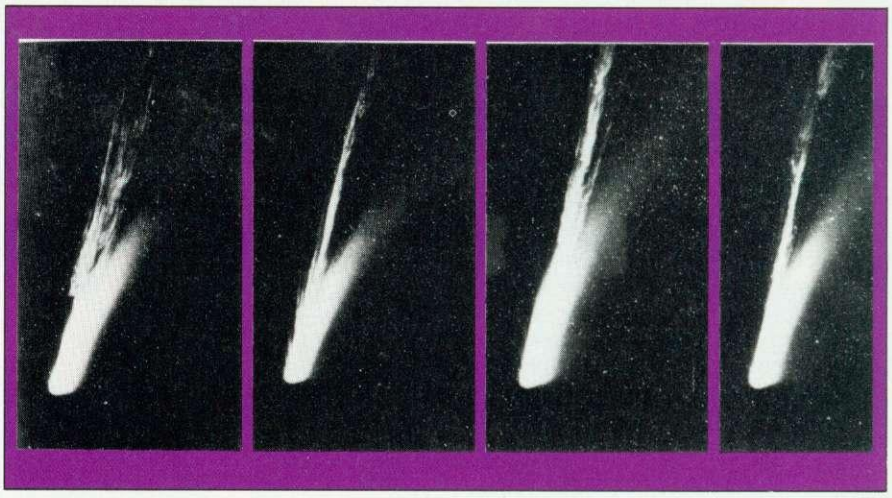


Figure 4. The Comet Mrkos photographed on several days in 1957

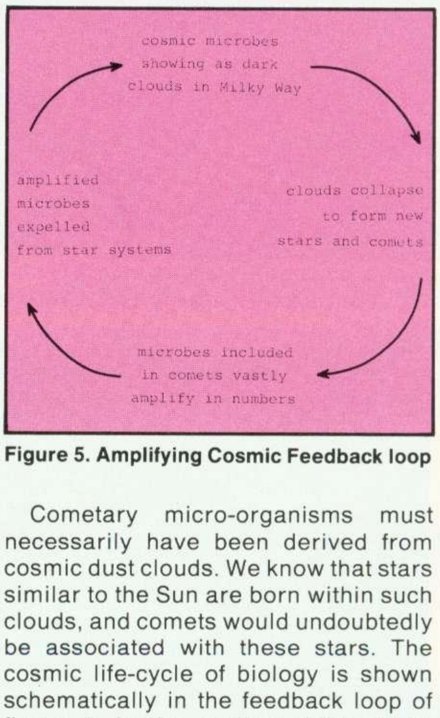


Figure 5. Amplifying Cosmic Feedback loop

Cometary micro-organisms must necessarily have been derived from cosmic dust clouds. We know that stars similar to the Sun are born within such clouds, and comets would undoubtedly be associated with these stars. The cosmic life-cycle of biology is shown schematically in the feedback loop of figure 5. In the earliest days of the Galaxy there need to have been only a small number of viable micro-organisms. Cosmic microbiology would become progressively amplified with every successive generation of stars. The great power of the feedback loop lies in the enormous replicative ability of biology: a single bacterial cell can double in a matter of hours.

At the present stage in the evolution of our Galaxy some 100 billion circuits in the loop of figure 5 would have taken place, one for every sun-like star. The total mass of material that has been biologically processed would measure some 10 ∧ 33 tonnes.

At the time the Earth formed as a solid body, biological evolution in the galaxy would already have been well advanced, and this heritage of evolution would have been trapped in the comets of our solar system. Cometary micro-organisms would have been raining down on the Earth essentially from the dawn of its creation. At the beginning, however, hostile physical conditions would have prevented the survival of any incident organisms, in the same way that organisms would now perish at the surface of the airless Moon.

Cosmic life took root on our planet at the very first moment when survival was possible, when the Earth had acquired its oceans and atmosphere nearly four billion years ago.

According to the present point of view the influx of cometary microbes must have continued unabated to the present day, some causing epidemic diseases in plants and animals, others generally adding to the microbial flora of our planet. Furthermore, and perhaps most importantly, the evolution of living forms on our planet would seem to be primarily controlled by the entry of new genetic information from cosmic micro-organisms.

NEXT in our Trailblazers series:

Scientists are using a BBC micro to roast weeds and give cocoa plants the kid-glove treatment. Find out why in next month's issue

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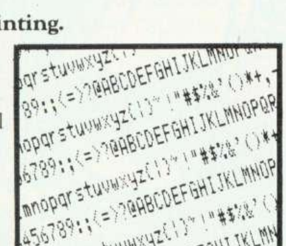


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SCALING MUSICAL HEIGHTS

Jeremy Vine conducts a musical lesson on the Electron

IN THE August issue of *Acorn User* we published some musical listings but you may not have understood how the programs worked. This month we'll look at the SOUND command available on the Electron and BBC and show how easy it is to produce music. You may have already experimented and created the odd sound or two but creating music is more complicated – but not too difficult.

The SOUND command has four parts to it and we can best understand its use by looking at each part in turn. Type in the following line:

```
SOUND 1, -15, 100, 20
```

The sound you can hear is the C above middle C and it is playing for one second. The SOUND statement is followed by four sets of numbers, each there for a specific purpose and determining the actual noise you hear. This can be more easily understood if we name each part as follows: SOUND C, A, P, D.

The first parameter C refers to the **channel number.** The Electron has four SOUND channels but unlike the BBC only one channel may be played at a time. These channels are numbered from 0 to 3, channel 0 being reserved for noise and channels 1 to 3 for tone. To hear the difference type in the SOUND statement above but change 1 to 0. Whether you type C as 1, 2 or 3 the tone will be exactly the same. These three tone channels produce the same effect and as only one can be used at any time we will use only the number 1 from now on when we need a tone. The other two channels (2 and 3) have been included to make the Electron compatible with the BBC micro.

The next parameter, A, is responsible for the **amplitude** of the sound and can represent one of three different things depending on the value assigned. If A is negative then the sound is 'on'; if set to 0 it is 'off'. However, if the number is from 1 to 16 inclusive an ENVELOPE of the same number will be selected. I won't cover the ENVELOPE command in this article but don't worry as we need not use it for the moment.

In my example I used −15 as the value. This means the sound is turned on. The reason for using this number is that it is the most common amplitude value used on the BBC on which you can alter the level of the sound. The sound level cannot be altered in the same way on the Elk but by using −15 we keep our programs compatible with the BBC.

The third parameter P stands for **pitch** and as the name suggests it controls the pitch of the sound output. This value can be in the range 0 to 255. Each step represents a change in pitch of a quarter-semitone and from this we can produce a range of pitches covering more than five octaves. Figure 1 shows these values and their corresponding pitches. Try changing the value of P to see how the pitch changes.

The final parameter, D, determines the **duration** of the sound and each step is equal to 50 milliseconds. In the example D=20 this is equivalent to keeping the sound on for 1 second. To work this out multiply D by 50 and divide by 1000.

Now we know how the SOUND command works, and the relationship between the pitch control numbers and the pitches they create, we can start to write music on the Electron.

Type in and run program 1. The program plays a chromatic octave of the 12 semitones from middle C. If we go back to my explanation of the pitch parameter, each unitary value is equal to a quarter-semitone. Therefore four units equal a semitone and octaves will therefore occur at intervals of 48 steps, because there are 12 semitones in an octave (ie, 12 × 4). To produce a different octave use figure 1 to look up the note of your choice and change the value 52 in line 20. Changing 52 to 68, for example, will play the chromatic octave from E instead of C.

Now you might be wondering how to

	Octave number						
Note	**1**	**2**	**3**	**4**	**5**	**6**	
B	0	48	96	144	192	240	
C	4	*52	100	148	196	244	*middle C
C#	8	56	104	152	200	248	
D	12	60	108	156	204	252	
D#	16	64	112	160	208		
E	20	68	116	164	212		
F	24	72	120	168	216		
F#	28	76	124	172	220		
G	32	80	128	176	224		
G#	36	84	132	180	228		
A	40	88	136	184	232		
A#	44	92	140	188	236		

Figure 1. Table of pitch values for each semitone

BUZZWORDS

Channel—The sound generator on a BBC micro can make up to four sounds at once, so it has four channels. Channel O produces specific noises, while the other three produce single notes. The Electron also has four channels but in effect only one channel can produce a sound at any one time.
Amplitude—The volume or loudness of a sound.
Pitch—The frequency of a sound.
Duration—The length of time a note plays.
Envelope—The volume (amplitude) and pitch of a sound rise and fall throughout the sound's duration, and both Beeb and Electron can use pitch and amplitude envelopes to give a sound 'shape'. These are set up with the ENVELOPE statement.

create a scale. So far we have played a series of semitones but a scale consists of both tones and semitones. Program 2 gets round this problem by inserting tones or semitones in the correct sequence. Line 70 holds the data for the tones (t) or semitones (s) and line 10 gives the user the choice of scale by entering the appropriate value of the starting note. If a tone is needed an extra value of 4 is added to the variable 'note' to extend the gap to 8 and therefore a whole tone.

Let's go one step further now and play a complete tune. Using the lookup table of figure 1 we now have enough information to convert musical notes into numbers that the micro will understand. That's one half of the conversion from a musical score to numbers; the second part is to tell the computer the duration of each note. Figure 2 shows the numeric values needed for note durations. We can therefore write each note as a pair of values, the first representing the pitch, the latter the note duration.

Program 3 follows such a method and a tune has been typed into the DATA statements in the form of pitch and duration values. By changing the numbers in the DATA statements you can write in your own tunes and the tempo can be altered by changing the value in line 10.

Entering music via DATA statements is fine but for the more enterprising composer there is no substitute for having a keyboard at the fingertips. Once more this is no problem to the Electron and with a bit of thought we can simulate a keyboard instrument. When playing a musical keyboard, notes can be short or sustained, depending on how long or hard a key is pressed. However, with the Electron pressing a key doesn't have the same effect – a note can be played long after the finger has been removed because it plays for a fixed length of time. To ensure that the note is played only while a key is pressed we have to repeat a note very fast instantly to ensure that no gaps occur and that when the finger is removed the sound stops. Program 4 does this. To hear the effect type in the listing and run it.

The important parts to note are the setting of the key delays *FX11 and *FX12, and the conversion of a note to a number. By using the INSTR function we can use the normal qwerty keyboard to represent notes. This is done by assigning all the notes to be used to a single variable 'note$' and then using GET$ to search for the occurrence of the pressed key within the string 'note$'. The key to this is the INSTR function and INSTR works by searching for a match of the string input to the one held in memory, in this case 'note$'. If a match is found the position of the key pressed within note$ is multiplied by four to give the numeric value for pitch (four being the starting point for the note C). For example if 'a' is pressed, the position within the string would be 1 and therefore C below middle C would be played. If the key pressed is 'f', the position returned would be 6 and 6*4 = 24. If you look this up in figure 1 you'll see the note to be played is F below middle C. By these means we have reproduced a keyboard spanning two octaves, depending on whether the key is lower or upper case.

This is not, of course, all that you can achieve with the sound chip of your Electron or BBC. In a future article we will take the story further and consider the use of the ENVELOPE command. If you can't wait, though, Martin Phillips has something to say about the subject in his Hints & Tips column.

Figure 2. Duration of the various notes

Note Name	Duration
Semiquaver	2
Dotted semiquaver	3
Quaver	4
Dotted quaver	6
Crotchet	8
Dotted crotchet	12
Minim	16
Dotted minim	24
Semibreve	32

Program 1. Chromatic octave of the 12 semitones from middle C

```
10 FOR pitch =
   52 TO (52+48) STEP 4
20 SOUND 1,-15,pitch,5
30 NEXT
```

Program 2. Tones and semitones to make up a scale

```
10 INPUT"Enter number
   to begin ie C=52",scale
20 FOR note = scale TO
   (scale+48) STEP 4
30 READ gap$
40 IF gap$="t" THEN note =
   note + 4
50 SOUND 1,-15,note,5
60 NEXT
70 DATA %,t,t,s,t,t,t,s
```

Program 3. Pitch and duration values combine to give a tune

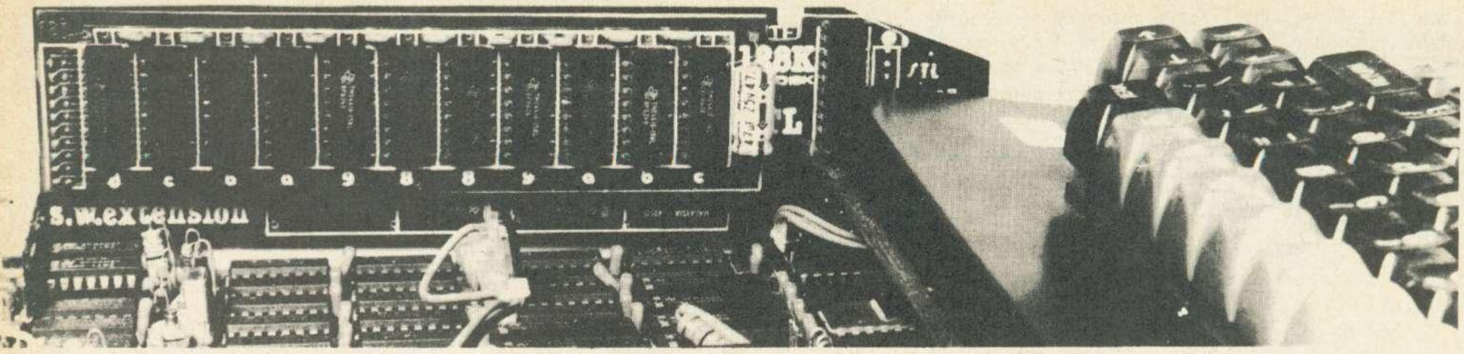
```
 10 REM Set tempo
 20 tempo=.75
 30 REM Read each pair of pitch
 40 REM and duration values
 50 READ note,duration
 60 REM If value = -1 then finish
 70 IF note=-1 THEN END
 80 REM Play selected note and duration
 90 SOUND1,-15,note,duration*tempo
100 SOUND1,0,note,2
110 GOTO50
120 REM Pairs of pitch and duration
130 REM numbers
140 DATA 68,16,68,8,96,16,96,8,76,12
150 DATA 80,4,76,8,68,16
160 DATA 96,8,108,8,116,16,108,8,96,8
170 DATA 104,8,88,8,96,16
180 DATA 116,8,116,16,116,8,108,16
190 DATA 96,4,96,8,88,8,80,8,76,8
200 DATA 60,16,68,16,96,8,88,16
210 DATA 80,8,76,8,68,8,60,8,68,16
220 DATA -1,-1
```

Program 4. Micro keyboard as musical keyboard

```
 10 ON ERROR GOTO 150
 20 REM Chromatic order of keys over
 30 REM 2 octaves.
 40 note$="awsedftgyhujkAWSEDFTGYHUJK"
 50 REM Set keyboard repeat rates
 60 *FX11,1
 70 *FX12,2
 80 n$=INKEY$(0)
 90 IF n$="" THEN GOTO 80
100 REM Conversion of note to number
110 pitch=INSTR(note$,n$)*4
120 SOUND &11,-15,pitch,2
130 GOTO 80
140 REM Reset key repeat rates
150 *FX11,50
160 *FX12,7
170 END
```

These programs, around which Jeremy Vine has written his article, were devised by Joe Telford

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The first step is to evaluate your needs.

You can buy a small unit to start with, and exchange it later for a larger one. Extra costs involved with upgrading are minimal. The SWR16, 16k sideways RAM is adequate for most simple tasks (running common programs or for Econet slave stations), including fast disk copying with a single disk drive.

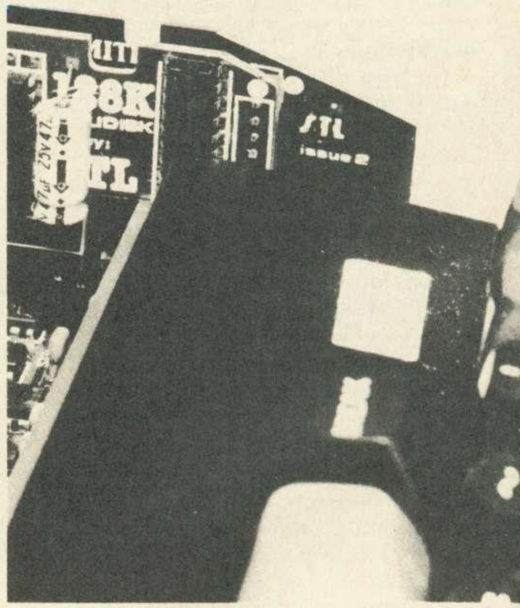
For wordprocessor: using VIEW or WORDWISE, a SWR32 will do. Large documents (20 page plus) will require something like SCRIBE and the 128k or 256k Solidisk**.

For database, unless very high speed is required, a SWR32 will suffice for most popular databases such as Beebase, Fileplus, Starbase, Datagem. Otherwise use the 128k or 256k Solidisk**. For the 6502 and the BITSTIK you will need the 256k Solidisk.

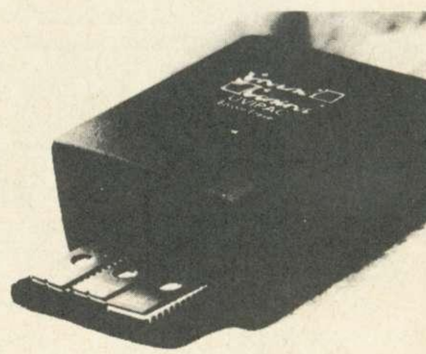
Remember — the more memory you instal inside the BBC computer, the more power you will get out of the machine.

All sideways RAM units come complete with 60+ page Sideways RAM User Manual, 1 utility diskette and 1 year warranty.

****Solidisk recommends SCRIBE and STARBASE because they exploit perfectly the inherent speed of RAM disc.** Quite often, some users try to solve a software problem (such as increasing the size of Wordwise) by a hardware solution (buying the 128k Solidisk). The better way is to buy Merlin's Scribe (or wait until we offer you one for free) and then increase its speed with the Solidisk. The situation regarding databases is much simpler as Solidisk works well with most of them (from 6 times speed increase with Beebug's Masterfile to 2 times with Starbase).



UVIPAC EPROM ERASER



TEAC DISC DRIVES FD55 Series



6 — SENDING FOR FREE SOFTWARE:

Our free software is divided into volumes and is available in single density, either 40 or 80 track 5.25" diskettes. 40 track diskettes contain only 1 volume, 80 track diskettes contain 2 consecutive volumes, (1+2, 3+4, 5+6, etc.)
All sideways RAM is supplied with 1 diskette, containing either VOL. 1 (40 tracks) or VOL. 1+2 (80 tracks) as requested. Extra volumes are charged for media and postage cost.

The following volumes are available at the present time:
- **VOL. 1:** General Utilities: Menu, STLDISC, STLOEOO, STLRFS, Printer Buffer, STLRFS, Quicky, Fastbackup, Keyboard, Word64, help!.
- **VOL. 2:** English Spelling Checker: Silexicon and English dictionary (15000 words).
- **VOL. 3:** BASIC program generator: Macro Basic. Never Bad Mode again: Virtual Memory.
- **VOL. 4:** Database: Solidisk Datafile.
- **VOL. 5:** Foreign Language Dictionary Generator: Silexigen, Silexicon source code for programmers.
- **VOL. 6:** French spelling checker (15,000 words).
- **VOL. 7:** German spelling checker (13,000 words).
- **VOL. 8:** Machine code tools: Solimon, the finest machine code monitor with Disassembler, debugger, single step etc. for both 6502 and 65-C-02 (for second processor. 65 C 02 assembler (for second processor), UVIPROM control software, SPRITES and SPRITE generator (providing 60 sprites per 16k sideways RAM).
- **VOL. 9:** to be released in October: Solidisk Toolkit, Rubber band, and Z80 drive C (RAM disc facilities for Acorn Z80 second processor).
- **VOL. 10 to 19:** Source code for use with the Technical Manual.

7 — TECHNICAL MANUAL:

THE TECHNICAL MANUAL contains extensive program listings and notes by their authors. It also covers the MACRO language programming (part of Macro Basic), MOS conventions for sideways software. Solidisk conventions for sideways RAM software, STL DFS entry points, the 65C02 programming facilities and schematic diagram.
The Technical Manual package consists of the Technical Manual and 3— 80 track diskettes containing VOL. 10 to 15 and costs £10.00.

8 — LOCAL EXPERT HELP:

A list of local Solidisk experts is printed in the Sideways RAM User Manual. For the cost of a local call, they can certainly help you with installation or software advice.
Potential experts are warmly invited to contact us.

SOLIDISK DUAL DENSITY DISK FILING SYSTEM

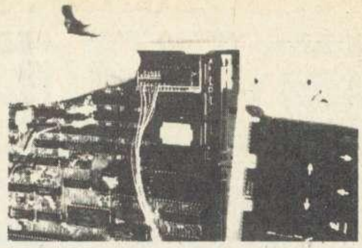
Solidisk Disk Filing System (STL DFS) is based on the Western Digital WD1770 Floppy Disk Controller for the BBC computer. Solidisk DFS features an AUXILIARY PORT with the possibility of having up to 8 disk drives (4 Double Sided), numbered from 0 to 7 with 2 simple connections. Thus it is possible to connect 4×TEAC 55F (or Mitshubishi's) with the same data cable, providing 2.8MB of storage for much less than having a fixed disk (and tape streamer or more floppy disks). The total cost of such a system (DDFS+4 Mitsubishi) is around £650 inclusive. Quite a few users especially schools with a large number of pupils, will find that it is a much better choice and technically speaking, installation is much simpler.

1 — SINGLE OR DOUBLE DENSITY?

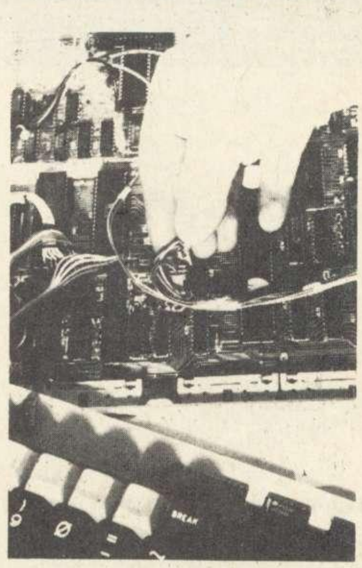
The difference is in the number of sectors per track you can get. With single density, STL DFS allows 10 sectors per track (Acorn format), with double density, this number is 16, an increase of 60% at no extra media cost.

2 — CONTENTS:

STL DFS consists of only 4 ICs to be plugged into existing sockets on the BBC computer board. They are labelled: IC 78, IC 79, IC 80 and the DFS ROM. Installation is quite straightforward and should not take nore than a few minutes.



Push in the base unit



Connect the control wires

PRICE LISTS AND ORDERING (including P&P and VAT)

SIDEWAYS RAM:	
SWR16	£43.65
SWR32	£59.95
128K SOLIDISK	£150.95
256K SOLIDISK	£257.95

The following are upgrade prices for existing Sideways Ram Users:	
16 — 32 (return complete item)	£19.00
16 — SOLIDISK (return item)	£110.00
16 — SOLIDISK 256 (return item)	POA
32 — SOLIDISK	£95.00
32 — SOLIDISK 256 (return item)	POA
128 — 256 (return item)	£125.00

DFS AND DISK DRIVES:	
SDDFS	£39.95
DDDFS	£49.95
Chip upgrade S —DFS	£11.00
DDFS — 1MHz bus version	£59.95
MITSUBISHI 2×80 (incl leads+manual)	£163.00
MITSUBISHI TWIN (incl leads+manual)	£323.00

COMPLETE SYSTEMS: (i.e. DRIVES+DDDFS):	
MITSUBISHI 2×80	£202.95
MITSUBISHI TWIN	£353.00

DISKETTES (Datalife Verbatim boxes of 10)	
SS/DD 40	£17.00
DS/DD 40	£23.00
SS/DD 80	£24.00
DS/DD 80	£29.00

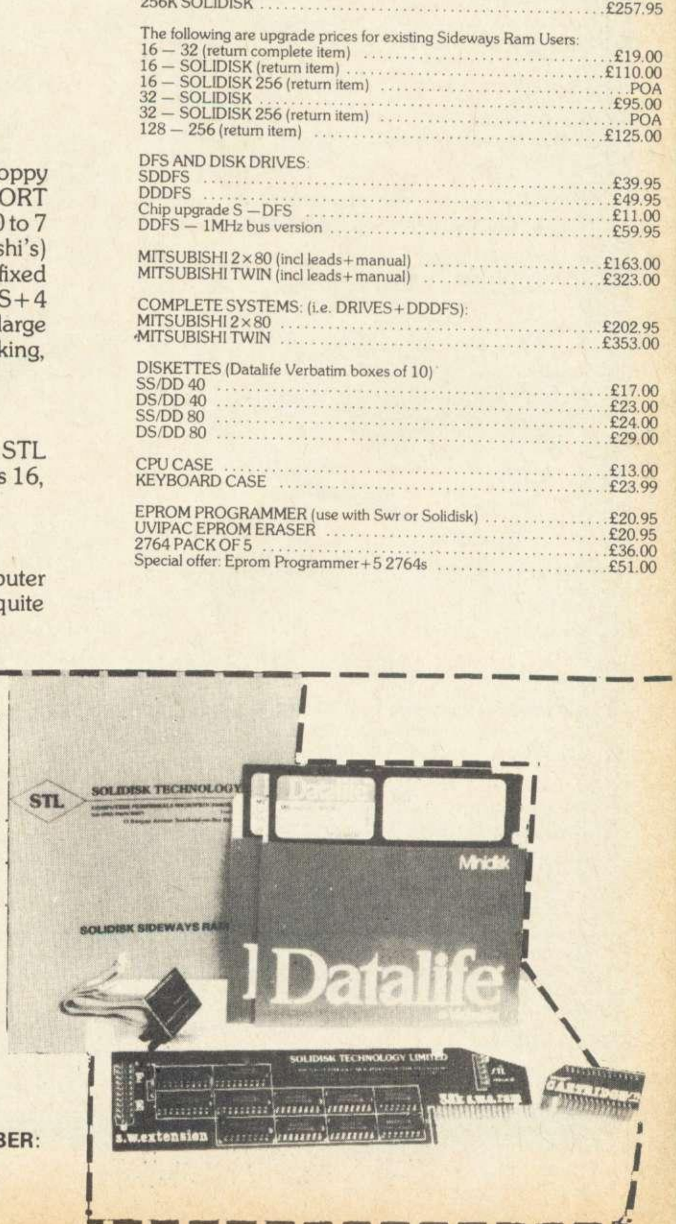
CPU CASE	£13.00
KEYBOARD CASE	£23.99
EPROM PROGRAMMER (use with Swr or Solidisk)	£20.95
UVIPAC EPROM ERASER	£20.95
2764 PACK OF 5	£36.00
Special offer: Eprom Programmer+5 2764s	£51.00

HOW TO ORDER?
You can order any item using the coupon. Post and packing is only charged once.
Access and Barclay card holders can place their order by phone.
Educational authorities, Acorn dealers and OEMs can obtain quantity discounts.

Name:
Address: ....
....
....
Credit Card Account:

Callers are requested to ring first for appointment.

Total: £



SOLIDISK TECHNOLOGY LIMITED
17 SWEYNE AVE
SOUTHEND-ON-SEA
ESSEX SS2 6JQ

SOLIDISK'S NEW TELPHONE NUMBER:
SOUTHEND-ON-SEA (0702) 354674
(10 lines with automatic exchange)

Watford Electronics

Dept. ACORN, CARDIFF ROAD, WATFORD, HERTS. ENGLAND
Tel: Watford (0923) 40588/37774 Telex: 8956095 WAELEC
ACCESS ORDERS Tel: (0923) 50234

SPECIAL OFFER

BBC Micro (Model B)

New Low Price
Only: £326
Price includes
a **FREE** Data Recorder
PLUS five software
programs worth £80.
(At Watford we give you a great deal for your money)

6502 2nd PROCESSOR	**£175**
Z80 2nd PROCESSOR	**£262**

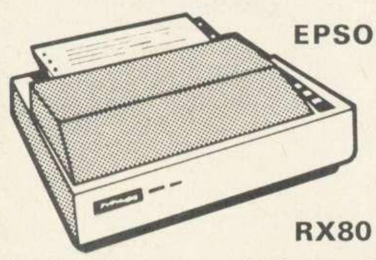
TORCH Z80 DISC Pack	**£695**
TORCH Z80 2nd Processor	ONLY **£295**

BBC Micro with ECONET	**£375**
ECONET Upgrade Kit	**£55**
File Server Level 1	**£85**
File Server Level 2	**£215**
Printer Server EPROM	**£41**
Clock Terminators (1 pair)	**£95**
10 Station Lead Set	**£25**
ECONET User Guide and Cable	**£10**

Dust Cover for BBC Micro

Protects your expensive Micro from foreign bodies while not in use. **£3.50**

EPSON



RX80

One of the classic printers: 100 CPS, 9 x 9 dot matrix, dot graphics, condensed, double width, normal and italic. 10" carriage; bi-directional logic seek. Centronics parallel interface.

ONLY **£229** (£7 carr.)

EPSON RX80 F/T PRINTER

As above but with friction feed capability built in. This allows the use of plain paper sheets.

£245 (£7 carr.)

PRINTER INTERFACE BUFFER

This neatly packaged, self-contained unit is supplied complete with all leads, operating manual and power supply. Computer output to the printer is stored in the buffer so that the computer can continue with other tasks while the printer works from the stored contents in the buffer. 16K holds approximately 10 pages of A4, close to the full memory of Wordwise. The 48K model is very useful for extremely large documents that otherwise tie the computer up for hours while being printed.

Price: 16K	**£115**
Price: 48K	**£149**

Epson FX80 Printer

The most popular printer in the Epson range. Features include 160CPS, 11 x 9 matrix, proportional spacing, superscripts, subscripts, graphics, many character fonts, user definable character set, margins. Tractor and Friction feed built in as standard. 10" carriage width with bi-directional logic seek for maximum speed. Centronics parallel interface standard.

ONLY **£316** (£7 carr.)

Type	Ribbons	Dust Covers
MX80FT	£4.75	£4.50
MX100/FX100	£10.00	£5.25
FX80	£4.75	£4.95
RX80	£4.75	£4.50
GP80	£4.50	–
GP100	£4.95	£3.95
GP250	£5.95	£3.95-
GP700	£18.50	
KAGA KP810	£5.95	
CANON PW1080	£5.95	

RX & FX PRINTER INTERFACES

Epson interfaces fit inside the printer to allow connection using techniques other than Centronics.

RS232	**£35**	RS232 + 2K Buffer	**£59**
IEEE 488	**£65**	2K Parallel	**£58**

BROTHER HR-15

DAISY-WHEEL PRINTER

This is a high-quality daisy-wheel printer, for the price of a dot matrix. Daisy-wheel quality gives a professional look to your correspondence. Facilities include 18CPS, bi-directional print, 3K Buffer with clear facility, carriage skip movement, text copy switch, proportional spacing, underlining, bold, shadow, super and sub-script, printing in two colours. Impact control allows use of carbon paper. Connects directly to the BBC micro with centronics parallel interface. RS232 interface is an optional extra. Other options are a single sheet feeder that automatically feeds up to 150 single A4 sheets and a keyboard to transform the printer into a sophisticated electronic typewriter.

SPECIAL OFFER
ONLY **£339** (carr. £7)

Single Sheet Feeder	**£195**
Electronics KEYBOARD	**£135**
TRACTOR FEED Attachment	**£90**

RIBBON CARTRIDGES:
Fabric **£3;** Carbon **£3;** Multistrike **£6**
DAISYWHEELS (various typefaces) **£18**

LISTING PAPER (Plain)

1,000 Sheets 9½" Fanfold Paper	**£7**
2,000 Sheets 9½" Fanfold Paper	**£13**
1,000 Sheets 15" Fanfold Paper	**£9**
Teleprinter Roll (Econo paper)	**£4**

PRINTER LABELS
(On continuous fanfold backing sheet)

1,000 90 x 36mm	**£5.50**
1,000 90 x 49mm	**£7.75**
1,000 102 x 36mm	**£6.25**

Carriage on Printer Paper or Labels £1.50

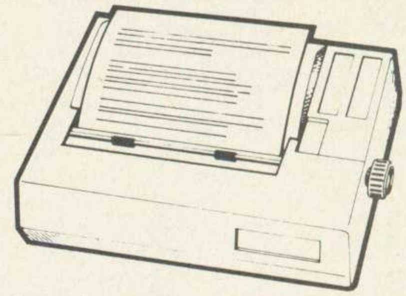
NEW **DPW1 120**

DAISY WHEEL PRINTER

At last a low cost, high quality daisy wheel printer that everyone can afford, yet there are no compromise in facilities available – 20 CPS, bi directional, logic seeking, print 10, 12 & 15 pitch, proportional spacing, QUME Protocols, QUME Ribbon, QUME Daisywheel 96 characters, maximum characters per line: 180 at 1/15" pitch, copy capacity: 4 copies Centronics Interface, Supports all Wordstar features, paper width 13" max., Optional extras: RS232-C Interface, tractor feed attachment, single sheet feeder.

Amazing Introductory Offer:
£219 (£7 carr.)

KAGA KP810



What do the press say:-
"At £269 this is an unbeatable product for what it has to offer." – Educational Computing.
"Offers excellent value for money." – Electronics & Computing.
This new Japanese printer has EPSON FX/RX compatible control codes and is functionally equivalent to an FX80 with the added advantage of its 'Near Letter Quality' mode. It is solidly built and features include: Normal, Italic, Enlarged, super/subscript, proportional spacing and user-defined character set. Extras over the FX80 included in the price are Near Letter Quality (NLQ) print ideal for correspondence, properadjustible tractor feed, half speed quiet mode and 3K buffer. The printer is bi-directional and logic seeking to give a speed of 140CPS for high throughput in conjunction with the standard 3K buffer. 8K RAM may be added to give more user-defined character sets. Centronics parallel interface + Watford's 12 month NO QUIBBLE WARRANTY.

Special Offer: ONLY **£235**

RS232 interface + 2K buffer to connect to other micros **£89**

KAGA KP910 PRINTER

Very similar to the KP810 but with 17" carriage for really wide print. Gives 156 columns of normal print or 256 columns in condensed mode. This printer is ideal for printing out spreadsheets and can also be used for correspondence in NLQ mode.

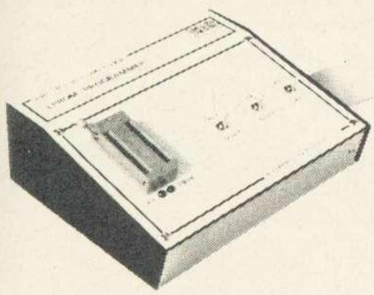
ONLY **£349**

PRINTER LEAD 36"

Centronics lead to connect BBC micro to EPSON, KAGA, SEIKOSHA, NEC, STAR, JUKI, BROTHER, SHINWA etc. printers.

STANDARD (3 foot long)	**£7**
EXTRA LONG (5 foot long)	**£10**

EPROM PROGRAMMER



The Watford Electronics' EPROM programmer for the BBC micro is a high quality self contained package. Programs all popular EPROMs from 2K to 16K: 2716, 2516, 2532, 2564, 2764 and 27128. All manufacturers' specifications have been followed to program EPROMs at the correct speed – wrong timings could destroy your EPROMs. The unit has its own power supply so does not put heavy loads on the BBC power supply as do some other units. Connects directly to the 1MHz bus following all Acorn recommendations on addressing and bus loadings.

SOFTWARE PACKAGE
The software is supplied on an EPROM which plugs into the Micro and is instantly available with a single command (no time wasting as on Cassette/disc loading). It is a fully purpose designed and integrated package to simplify ROM development. The system is menu driven with many prompts to avoid any accidents.

Software facilities include:
Load File – Save File – Down Load EPROM – Program EPROM – Verify – Blank Check – Editing of memory contents prior to programming.
Also included is an automatic system to allow Basic programs to be put in EPROM and accessed through the *ROM filing system. More than one program may be put in an EPROM. All these facilities and more are explained in the comprehensive and clear 15 page manual.

ONLY **£79** (£3 carr.)

WATFORD – Always a step ahead

TEX EPROM ERASERS

EPROMs need careful treatment if they are to survive their expected lifetime. Over erasure of EPROMs very rapidly turns them into ROMs! The TEX erasers operate following the manufacturers specifications to give the maximum possible working life by not erasing too fast. We use these erasers for all our own erasing work.

- **ERASER EB** – Standard version erases up to 16 chips. **£28**
- **ERASER GT** – Deluxe version erases up to 28 chips. Has automatic safety cut-off to switch off the UV lamp when opened. **£30**
- Spare UV tubes. **£9**

NEW DESIGN PLASTIC LIBRARY CASES

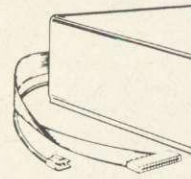


for Disc Storage 5¼" (holds 10) **£2**

DISC DRIVES

(All Drives are NEW SLIM-LINE Type)

NEW LOW PRICES

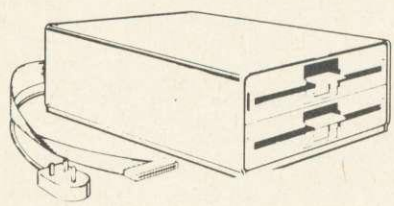


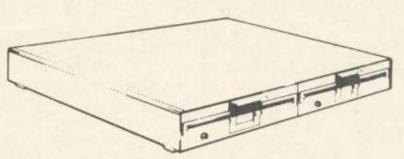
(DRIVES Cased with Cables; connects directly to your BBC Micro)

- **CLS 100** Single, TEC Single sided 40 track 100K, 5¼" Disc Drive **£112**
- **CLS200** Single Drive, Double sided 40 track, 200K, 5¼" **£129**
- **CLS400** Single, Mitsubishi Double sided 80 track 400K, 5¼" Disc Drive **£165**
- **CLS400S** Single, Mitsubishi Double sided 40/80 track Switchable, 400K, 5¼" Disc Drive **£199**
- **CLD200** TEC Single sided 40 track 200K, twin 5¼" Drives **£225**
- **CLD800** Mitsubishi Double sided 80 track 800K, 5¼" TWIN Drives **£325**
- **CLD800S** Mitsubishi Double sided 40/80 track switchable, 800K, Drives **£349**

P.S.
You do not require a formatting disc nor the expensive 40/80 track switchable drives if you use Watford's sophisticated Disc Filing System which has all these facilities in the ROM.

(CUMANA) DRIVES CASED WITH PSU & CABLES





- **CS100** TEC Single sided 40 track 100K 5¼" Single Disc Drive **£129**
- **CS200** TEC Single sided 80 track 200K 5¼" Single Disc Drive **£175**
- **CS400** Mitsubishi Double sided 80 track 400K 5¼" Single Drive **£199**
- **CD200** TEC Single sided 40 track 200K 5¼" TWIN Disc Drives **£265**
- **CD400** TEC Single sided 80 track 200K 5¼" TWIN Disc Drives **£349**
- **CD800** Mitsubishi Double sided 80 track 800K 5¼" TWIN Drives **£399**
- **CD800S** Mitsubishi Double sided 40/80 track Switchable 800K TWIN Drives **£425**
- SPARE DRIVE CABLES, SINGLE **£6**; DUAL **£8**
- DFS Manual (comprehensive) **£7.50** (No VAT)

DUST COVERS

(For our Disc Drives)

Single (without PSU)	**£3.20**
Twin (without PSU)	**£3.85**
Single (with PSU)	**£3.25**
Twin (with PSU)	**£3.90**
Twin (side by side)	**£3.95**

5¼" DISKETTES

Top quality 3M and XIDEX diskettes with a lifetime guarantee. These discs are quiet in operation and insert positively with their reinforced hub rings. Boxes of 10 supplied with disk labels and write protect tabs.

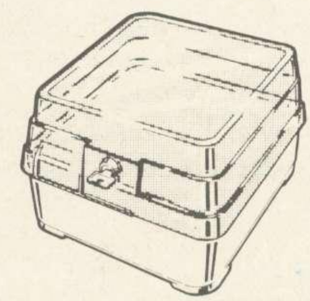
- 10 SCOTCH / 3M + labels S/S S/D **£15**
- 10 SCOTCH / 3M + labels S/S D/D **£17**
- 10 SCOTCH / 3M + labels D/S D/D **£24**
- 10 XIDEX + labels S/S D/D **£15**
- 10 XIDEX + labels D/S D/D **£24**

DISC ALBUMS

Atractively finished in beige leather-look vinyl, these conveniently store up to 20 discs. Each disc can easily be seen through the clear view pockets.

£4.25

LOCKABLE DISK STORAGE UNITS



Strong plastic cases that afford real protection to your discs. The smoked top locks down. Dividers and adhesive title strips are supplied for efficient filing of discs.

M35 holds upto 40 discs	**£13**
M85 holds upto 95 discs	**£18**

FLOPPY HEAD CLEANER KIT

The heads in a floppy disc drive are precision made and very sensitive to dirt. Drive manufacturers recommend that you clean the heads approximately once a week. Unless your home or office is dust free one of these kits is a very sensible precaution against losing valuable data. A dirty head can destroy many disks before you realise the trouble. Very simple to use.

Only **£14**

BBC Micro WORD-PROCESSING PACKAGE

A complete word-processing package (which can be heavily modified to your requirements, maintaining the large discount). We supply everything you need to get a BBC micro running as a word-processor. Please call in for a demonstration.

EXAMPLE PACKAGE
BBC Model B, Watford Electronics' DFS upgrade, Twin 200k Teac drives in beige, Zenith 12" Hi-resolution monitor (Green or Amber), Brother HR15 daisywheel printer. Gemini software: BEEBCALC spreadsheet, analysis and DATABASE software on disc. 10 x 3M discs, 500 sheets fan-fold paper, 4way mains trailing socket, manuals, all leads and BBC carrying case.

ONLY **£1,189** (£15 carr.)

ACCESS HOT LINE (0923 50234)

(24 hours)

Continued →

BEEB PRINTER ROM



"Makes Printing Childs Play"

This utility ROM is designed to simplify using all the facilities of your printer. It has many facilities:

★ Selection of printer modes such as underline, font and size is by 'Single Key' operations.

★ From Wordwise, a single number following OC will select a mode rather than a long and incomprehensible string of control codes. This makes using your printer with Wordwise much more convenient.

★ When using Basic (or other languages) you can have control over the formatting of the output to the printer in the style of a wordprocessor. You can define page top, bottom and side margins etc. with intelligent page skip for binders an option. All supported printers will now respond to form-feed etc. commands.

★ User defined characters are printed as you see them on the screen so that non-standard characters are automatically printed out correctly.

★ Commands select the options for the following printers:
GP100, STAR, NEC, MX/FX, KAGA, LP/VII/DMP100, DMP200.
Operates with either parallel or serial interfaces.

★ Supplied with a 50 page manual that is very comprehensive and easy to follow. Please specify printer type when ordering so that we can send the correct function key strip.

Price: £24

DUMPOUT 3

A highly sophisticated screen dump ROM. This has to be the most flexible and powerful screen dump ROM yet produced for the BBC micro. It will put on paper anything you see on the screen, including all Mode 7 facilities etc. We have to admit that there is one facility that we cannot replicate – if anyone can supply flashing ink we would like to know!
The ROM also provides window setting facilities and two new OSWORD calls that allow mode 7 graphics pixels to be read and plotted using the standard graphic co-ordinate system. Two commands are used to operate the dump routines:
*GIMAGE – This provides a full graphics dump of any Mode (including Mode 8). There are various optional parameters but you need only specify the parameters you wish to change.

● V <scale>, H <scale> – These 2 byte numers give fine control over the size of the dump from minute to enormous. Unlike other dump ROMs the scale does not change with mode.

● R <0-3> – Print dump rotated by 0.90, 180, 270 degrees.

● I <indent> – Set gap from left edge of paper.

● X <min>,<max>, Y <min>,<max> – The whole of the screen graphics window area is dumped except when these parameters are given.

● P – Physical colour values are used for plotting, otherwise a negative scale is used (white darkest).

● T Two tone dump for maximum resolution.

● M <mask> – 8 bit colour mask.

● E – Contrast expansion to make mode 7 text and separated graphics stand out from the background.

● C – All mode 7 graphics are printed as contiguous to improve the shading in graphic areas.

*TIMAGE <indent> – Does a fast, text only, dump of the contents of the text window in any mode.
*GWINDOW and *TWINDOW – These commands draw the graphics and text windows, respectively, on the screen and allow them to be changed with the cursor keys. N.B. GIMAGE and GWINDOW work fully in mode 7.
Designed for use with the following printers: CP80, GP80, GP100, GP250, STAR, KAGA/TAXAN, NEC, SHINWA, GEMINI, EPSON MX/RX/FX.LPVII, DMP 100/120/200/400, CANON.

Price including comprehensive manual **£22**

APPROVED for use with telecommunication systems run by British Telecommunications in accordance with the conditions in the instructions for use.

MODEM 84

PRESTEL TERMINAL

For the BBC Microcomputer



The Watford Prestel package allows B.T. approved connection to Prestel, Micronet and many other 1200/75 baud databases for about the cost of a good tape recorder.
Prestel gives you access to an incomparable database covering almost every subject under the sun. There is Micronet with lots of free programs that you can download and run. Details of clubs and user groups, a diary of meetings and exhibitions, news and reviews, technical information etc. There is Homelink with online banking. And there is armchair shopping, travel information, entertainment, world news, sports news, weather information, electronic mail and lots more.
The basic Prestel subscription is only £5 per quarter and at off peak times there is no charge for access time. A local phone call facility means no long distance phone calls to Prestel (approx. phone cost is only 40p per hour).
The Watford Prestel package consists of the B.T. approved Watford MODEM 84 (1200/75 baud full duplex 1200 baud half duplex direct connect) and a very sophisticated Prestel Terminal ROM.
This totally machine code software:

● is fully compatible with not only the Modem 84 but also with the PRISM 1000 and most other modems that require a data link via an RS423/RS232 port making it a worthwhile purchase for those who already have Modems.

● supports full Prestel colour alpha and graphic characters including double height, flashing, conceal/reveal.

● called by simple *PRESTEL (*P.) command. Disc and tape configurations fully supported.

● includes a comprehensive telesoftware downloader for BBC and other programs with continuous on screen status report (an essential facility).

● has very powerful OFF LINE MAILBOX editor allowing colour flashing graphic mailboxes to be prepared without having to be on line to Prestel.

● auto logon sequence can be burnt into ROM if desired.

● a vital 'TAG' facility allows tagging and recall of interesting pages, avoids that common and annoying 'NOW WHERE WAS THAT PAGE' problem.

● includes simple page and program loading and saving functions for both disc and tape, automatically assigning frame and program directories.

● not one but TWO PRINTER DUMP ROUTINES are provided within the software allowing either full graphics dump (mode 7 to EPSON compatible printers) or ASCII characters only.

● a user function built into the software allows interface with specialist routines, (yours as well as ours).

● All the above facilities are accessed via function keys. An overlay is provided to give comprehensive guidance to key functions.

● A 34 page comprehensive instruction/operating manual is supplied.

WATFORD'S 1200 BAUD FULLY AUTOMATIC USER TO USER SOFTWARE

Having purchased the WATFORD PRESTEL TERMINAL which includes the 1200/75 baud MODEM 84 the addition of the WATFORD user to user ROM based software enables you to discover a whole new world of data communication.
This software enables you to use the MODEM 84 very powerfully.

● Send and receive error checked programs and files (even WORDWISE files) to and from other users at 1200 baud.

● 8k file transfer in under 2.5 minutes (approx four times faster than with 300 baud modems).

● The transfer of data is totally AUTOMATIC which means that the modem is automatically switched between transmit and receive under software control.

● A chat mode is provided which also has this automatic switching for receive and transmit. (This mode is essential just before and after data transfer when both hand sets are replaced to reduce noise).

● A copy facility is provided which allows transmission of all screen output.

● A continuous on screen modem status report is included.

● The software is totally function key driven enabling easy transmission, reception, saving and loading of programs and files (Basic, Machine code or Data).

● A help menu is available from within the software as an aid to use.

● Full instructions are supplied.

PRICES

PRESTEL SOFTWARE ROM ONLY
(incl. Comprehensive Manual **£20**
PRESTEL PACKAGE comprising:
WATFORD MODEM 84, SOFTWARE ROM and Comprehensive Manuals ....
£82 (carr. £2)
USER TO USER SOFTWARE ROM **£14**

VIEW

VIEW WORDPROCESSOR
We are supplying the new VIEW version 2.1 allowing printing of memory contents etc. .. **£49**

FX80 PRINTER DRIVER

Watford's own TWO Sophisticated PRINTER DRIVER for VIEW

To simplify using the full facilities of the Epson FX80 or Kaga KP810 use this printer driver. Full facilities are provided for selecting between fonts etc. The disc includes examples of use and instructions. Available on 40 or 80 track disc (please state which required). **£6**

WATFORD ELECTRONICS VIEW PRINTER DRIVER FOR SILVER REED

We are pleased to introduce a new range of printer drivers to complement the Silver Reed range of printers and typewriters and the View wordprocessor. These drivers have been officially approved by Silver Reed, for use with their printers and typewriters.
The View driver allows access to all of the features supported by the range of daisy wheel printers (EXP 700/400/500/550). These include underlining, bold, shadow, superscript, and subscript printing. Additionally, you can use proportional spacing on the EXP 700. Owners of one of the typewriters in the range EXP 55/44/43, using it as a printer, can also access underlining with these drivers.
The features of each printer/typewriter are accessible from the two highlight codes, which can be redefined at any point within the text. The printer drivers also extend the facilities in View to allow the use of pad characters.
The printer driver on disk with a user manual is at a special introductory price of **£7.50.**
Please specify printer type when ordering.

EPSON DUMP ROM

This screen dump ROM is specifically designed for use with the Epson RX/FX printers and the Kaga KP810. It is extremely simple to use as there is only one command to remember. It will accurately dump any screen mode using multiple tones as required. Mode 7 is fully supported giving teletext graphics, double height etc. For those who like to keep life simple this EPROM is only **£20**.

FORTH ROM for BBC

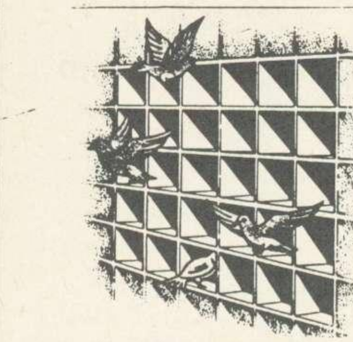
This ROM provides a complete implementation of the FIG-FORTH standard (including editor). Supplied with a large tutorial manual at only **£33**

TINY PASCAL for BBC Micro £59

WATFORD ELECTRONICS

Continued →

TWO DATABASE MANAGEMENT SYSTEMS



DISCDATA

Discdata is an entirely disc based database handling system. It is extremely easy to use through its comprehensive menu system. The simplicity is such that we do not feel the need to provide explanation on use in the written guidance supplied with the program. The first-time database user will rapidly become familiar with this package designed throughout to be simple and obvious.
Despite the ease of use this system provides all the facilities needed for complex data handling problems. The length of database that can be handled is only limited by the total space on the disc. You can have up to 20 fields with page length records up to 254 bytes in length. Adding and deleting records, amend titles, field names and records. Sort on any field and search for any record or group of records in any field. The *database may be re-formatted after creation, the* system will re-write all your files for you automatically. You may add extra fields and extend the length of existing fields freely.
Output formatting is very powerful. You are allowed 40, 80 or 132 column output modes going to printer or screen. Selected fields can be put in any order on the screen or printer, either across the paper or down. Output can start or stop anywhere in the file. Decimal fields are automatically totalled and records output are counted. Version 2, now on sale has improved input and amendments procedures giving full record edit as well as the 3 extra features . . . String searching, Calculations on numeric fields, and the ability to create sub files from your main files.

On disc at **Only £17**

(Please specify 40 or 80 track when ordering)

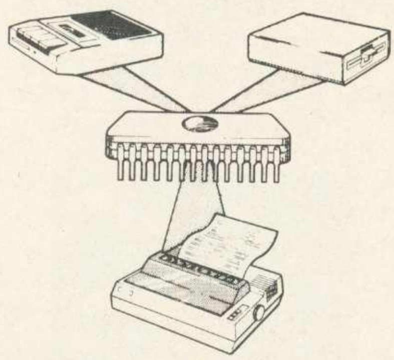
FILE-PLUS

The File-Plus package is even more powerful and flexible than Disc-Data. It is also largely menu driven but has its own command language for file searching. The 16K ROM contains all the normally required routines, with lesser used options supplied on the utilities disc. All input and output formatting is controlled through screen forms. A full screen editing system is used to define a form which allows tremendous flexibility in the format in which your data is displayed. It is very easy to change from form to form so that you can type in your data with one form, and examine it with others. You will typically design several forms before starting to access the database so that you can quickly and easily see the fields of each record that you want to appear in the layout you decide on. The form system is also used for output to your printer.
File Plus has a unique file linking system that allows the entire on-line storage of your system to be used for one database. This can give around 1.5 Megabyte databases using dual drives and double density.
The built in FQL (File-Plus Query Language) can be used for searching the database. Presented in the form of a powerful command language with looping facilities etc. this allows the most flexible access to your data possible. Full arithmetic operations are provided to allow the system to be used for statistical analysis. Operations supported are −, +, *, /, +−999999999.9999 and compare facilities = >,<>,+=, >=, <, &,.
Many keywords are supported by the language: assign, compare, display, end, goto, iff, ift, print, read, search, spool and update.
Supplied with a very detailed 70 page manual to explain all the facilities with many examples.

Only £43

(Please specify 40 or 80 tracks for the utilities disc)

BUFFER & BACKUP ROM



For those with sideways RAM fitted in their machines this utility ROM will make full use of this facility. By using the sideways RAM area for extra memory the following features are implemented:
★ 4K or 16K buffer for parallel printer.
★ Dumps selection of Disc files to Tape.
★ Makes backup copies of tapes on to tape and disc.
★ Displays contents of paged ROMs on screen.
★ Menu display of ROM filing system contents on Shift-Break.
★ Comprehensive manual.

Only £22

DATAGEM

Gemini's 24K ROM based DATABASE Management System

Special Introductory Offer: **£99**

WONDERFUL WATFORD

PEN PAL—VERSATILE LIGHT PEN SOFTWARE

Do you have a light pen that never gets used? Then this piece of software is for you. This package offers many useful facilities that make the light pen a useful device to own. Facilities included are:
- Pixel, Line and Character definition
- Free hand drawing
- All Colours
- Fill, Refill and stripes
- User defined "Brush strokes" plus character definer
- Grid, Scale and perspective aids 2 to 200 points palletable in one design with Circles and "rubber banding"
- Move design/character to any screen position
- Save and Load screens, User defined characters and line drawings for video titles, own programmes etc.

This program has many uses in education and at home. It is supplied with a comprehensive instruction manual.
Works with Watford, RH, Acorn User, DIY and many other Light Pens.
Prices

TAPE	£10
DISC (40 or 80)	£11

DISC EXECUTOR

Disc Executor is a sophisticated disc utility for the transfer of your cassette programs to disc. If you have difficulties transferring your cassette software to your disc system then this is the answer. It handles 'locked' files and full length adventures (up to &&e blocks) and programs that load below &E00. It is very simple to operate with instructions supplied. It saves you time and money.

Price **£10**

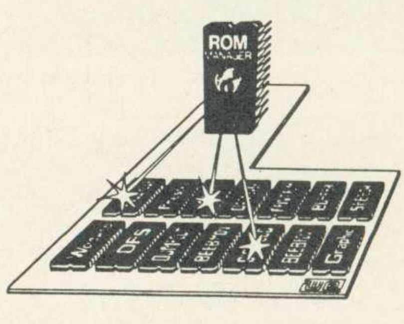
(Please specify 40 or 80 track discs)

ADE

Complete program development package in a 16K ROM. Full assembling and debugging facilities provided.

SPECIAL OFFER ONLY **£43**

ROM MANAGER



This ROM is unique in its capabilities. It allows you, the user, full control over the BBC Micro's sideways ROM paging system with simple to use commands. This ROM is essential for those with several ROMs. At a simple level ROM MANAGER can be used to remove the problem of clashing command names and allow full use of all the facilities of your ROMs. This is coupled with facilities to completely enable or disable various ROMs in the machine including ROM manager itself.
ROM MANAGER can also be used to develop sideways ROMs using the machine's standard memory. This is achieved by sending sideways ROM calls to your code in RAM, saving the expense of fitting sideways RAM for ROM development purposes. ROM status reports are also given by the ROM, including ROM lengths, checksums, entry points supported and current filing system title.
The ROM also provides facilities to examine ROMs, list function keys for editing, modify RAM (using a HEX/ASCII editor) and list ROM titles neatly and concisely.

The commands given in the ROM:
*** CHECKSUM** – Generates a CRC for a specified ROM (useful for testing suspected faulty ROMs).
***DIRECT** – Passes a command directly to a named ROM (overcomes command name clashes).
***EXAMINE** – Allows examination of a named ROM
***EXPLAIN** – Gives detailed explanation of the first 22 *FX codes.
***FILE** – Passes a command directly to the current filing system (which normally receives commands after all the ROMs).
***FUNCTION** – Lists the contents of the function keys in a form suitable for editing.
***INCLUDE** – Allows the main memory to be used for ROM development.
***MODIFY** – Memory editing in HEX/ASCII format.
***NAMES** – Lists the names and socket numbers of all resident ROMs.
***RAM** – Sends command directly to the RAM based ROM routine.
***REMOVE** – Removes RAM based ROM option.
***SPECIFY** – Selects the default ROM.
***DEFAULT** – Sends commands directly to the default ROM without having to give its name.
***STOP and *START** – Disable and enable any named ROM to completely eliminate command word clashes.
***STATUS** – Information about all the ROMs fitted in the machine including socket number, name, length, whether it is enabled, whether it has service or language entries etc.
***VALUES** – Gives ROM MANAGER status information, such as its socket number, how many ROMs have higher priority, number of default ROM and the identity of the current filing system.
***VECTOR** – Same as *DIRECT, just in case *DIRECT clashes with another ROM.
All selection between particular ROMs is by the name of the ROM and this may be abbreviated for convenience. ROM numbers can also be used if required. This ROM is very simple and obvious to use. All the facilities are explained in the clear and detailed manual.

Price **£22**



Watford's own Machine code Monitor ROM written by Andrew Bray (Cambridge), co-author of the BBC Micro Advance User Guide.

The most powerful and versatile machine code monitor ROM yet written for BBC Micro. It has all the normal memory editing, moving and relocating facilities, plus all editing is with a full screen editor allowing scrolling up and down memory, entering in Hex, ASCII or standard assembler mnemonics.
In use as a debugging tool, you run code under a total emulation system. Everfelt a desperate urge to set a break point in ROM? No problem – you can even have breakpoint on reading or writing locations in memory and on register contents. The system fully supports debugging of sideways ROMs e.g. BASIC can fully and easily be run from within Beebmon and from there DFS and other sideways ROMs can be used in total emulation mode.
Beebmon can even run itself. In so doing you can nest Beebmon up to a level limited only by the memory size. Beebmon uses 256 bytes of workspace, located anywhere in memory, even on the 1MHz Bus. Beebmon effectively uses no zero page workspace, so your program (e.g. BASIC) can use any or all of the base page. How does it achieve this? By providing a 6502 interpreter all programs running under it exist in a vertual BBC, so special memory locations like the ROM latch are not actually accessed by your programs, instead they alter a location in Beebmon's workspace. Emulation also allows immediate return to Beebmon command level by ctrl-escape no matter what code is being excuted at the time. All this exceptional power and flexibility is complemented by a clear and detailed manual included in a value for money price of:

£22



Discover the hidden secrets of BASIC and the OPERATING SYSTEM with this easy to use programmers tool.
A ROM based machine code Disassembler for the BBC micro. It enables machine code programs to be listed in BASIC/DUMP format and thus is the perfect complement to the built in assembler. It allows Sideways ROMs, files on disk or tape to be listed, and also has a comprehensive editor, allowing mnemonics to be altered directly, as well as HEX, DECIMAL, ASCII and BINARY memory editing. There is also a full set of labelling facilities available (up to 3,200 labels), with the major locations and routines already labelled.
Thus DIS-ASM enables any monitor program, such as BEEBMON to be used to much greater effect as it is not necessary to disassemble memory each time the display is altered.

ONLY **£18**

WATFORD – Always a step ahead

COMPUTER CONCEPT'S ROMS

CARETAKER Basic Utility	**£28**
Graphics ROM	**£28**
Disc Doctor ROM	**£28**

Wordwise

Without doubt a very sophisticated piece of software for the BBC Micro. It has all the features of a professional word processor yet is easy to use.

SPECIAL OFFER THIS MONTH: **£32**

BEEBFONT ROM

BEEBFONT is a remarkable and different concept in BBC software supplied on a 16K ROM. It allows you to display text on the screen in any of the following styles:

ABCDEFGHIJKLMNOP
abcdefghijklmnop
ABCDEFGHIJKLMNOP

ABCDEFGHIJKLMNOP
abcdefghijklmnop
ABCDEFGHIJKLMNOP

ABCDEFGHIJKLMNOP
abcdefghijklmnop
ABCDEFGHIJKLMNOP

ABCDEFGHIJKLMNOP
abcdefghijklmnop
ABCDEFGHIJKLMNOP

ABCDEFGHIJKLMNOP

It works in modes 0, 1, 2 and 4 using the full colour capabilities of each mode. Characters are printed in the same way as normal. Selection between the various fonts is very easily achieved with Ctrl-V – press this followed by a font number and the output will continue in the new font. Beebfont ROM is particularly useful in display work with the characters produced at twice the normal size.
You can create your own character fonts with the editor supplied. You can also print-out pre-formatted text files using the special characters with Epson FX, RX and NEC printers. The full range of character styles can be used, controlled from within the text. The editor and spooler program are supplied with the package, on cassette or disc. The spooler allows word processor (Wordwise & View) output to be printed in the new characters.
A twenty page manual is supplied. Please state printer type and media for the editor & spooler when ordering (cassette, 40 or 80 track disc).

ONLY **£39**

NEW LAUNCH

32K RAM
EXPANSION BOARD

Now Watford Electronics brings you the latest state-of-the-art memory expansion board for your BBC microcomputer. This compact board which fits inside the computer does not just give you 16K or even 20K of extra RAM, but a massive **32K!!!**

There are many useful facilities available with this board:

- The top 20K of the expansion RAM can be used as the screen display memory, leaving all the standard BBC RAM free for programs or data storage. This allows good graphics and long programs to be combined. For instance you could have MODE 0/1/2 GRAPHICS AND 28K OF PROGRAM SPACE. The extra memory can be used by virtually any language or utility such as BASIC, VIEW, WORDWISE, etc.
- The full 32K or the bottom 12K of the expansion RAM can be used as a buffer for the printer, sound channels, RS423, keyboard or speech synthesiser. This allows very long text files to be printed while you are using 27K of program and 20K of graphics!
- This board is the ideal complement to any word processing system. There is no need to wait for slow printers as you can type in long text in 80 column display mode while printing is going on – TWO JOBS DONE SIMULTANEOUSLY!!! (an equivalent printer buffer would cost you £115+).
- The board is compatible with a vast range of software and hardware available for the BBC microcomputer, including our ROM expansion board and double density DFS.
- The board is extremely easy to fit. It is supplied complete with a comprehensive manual and ROM based software with full *HELP messages.

SPECIAL INTRODUCTORY OFFER
Only: £69 (carr. £1)

GRAPH PAD

With this popular British Micro's Graph-pad, you can add new dimension to your computer enjoyment. It helps you to create your own application programs by the simple use of the Graphpad. Ideal for Educational use. Supplied complete with Cables, Manual and a two program cassette.

Price: **£115**

SURGE PROTECTOR Plug

Fitted in place of your normal mains plug, this device protects your equipment against mains surges. Nearby lightning strikes, thermostats switching and many other sources put high voltage transient spikes on to the mains. This can lead to data corruption in memory and on disc and can result in spuriously crashing machines. Suitable for computers, Hi-Fi, Fridge Freezers etc. Max. Surge current 2KAmp; max. Voltage 250. Essential for serious computer users.

Protection for only **£8.50**

WATFORD ELECTRONICS

Continued →

DOUBLE DENSITY DISC INTERFACE

We are proud to announce the launch of the Watford Electronics Double Density Board for the BBC micro. The DDFS supplied is a new version of the popular Watford Electronics DFS re-written to make full use of the capabilities of the new double density controller.

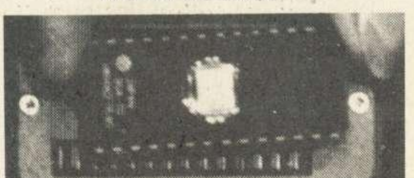
- Storage is increased by the maximum physically possible, 80%.
- Our system will use the whole of an 80 track drive. Inferior systems do not allow files longer than &3FFFF bytes, but with our system files can be as long as one disc side.
- Discs may be created in either single or double density format with the built in formatter and in single density mode are fully compatible with normal Acorn format discs.
- The density of the disc you put in is automatically sensed by the system and you are informed of the density in the catalogue display.
- The double density system is of course faster than single density.

Worried about compatibility with single density discs? Don't. The Watford Electronics DDFS implements an extremely comprehensive 8271 emulator so that commands passed through OSWORD &7F are correctly interpreted. Other manufacturers thought that read and write sector alone were sufficient – we decided to implement every command of the 8271 that was physically possible. We have allowed the use of all the special registers including bad tracks, allowed access to deleted data etc., etc. The emulator itself takes up around 1K of compactly written machine code. We reckon it will run the vast majority of protected discs now available.
Gain all the advantages of the WE DFS together with much increased storage and compatibility with existing protected discs. The price is the same as for the standard single density system that we continue to sell so you can choose between the two options without financial worries.

NEW LAUNCH

SIDEWAYS ZIF

External sideways ROM socket



At Watford we haven't forgotten those of you with small budgets, so we've produced a ROM board which takes only one ROM! But don't stop reading – this ROM can be changed in under five seconds without taking the case apart.
The SIDEWAYS ZIF eliminates the possibility of damage to your ROMs as zero insertion or extraction force is required when changing ROMs.
Included in the SIDEWAYS ZIF package is a specially designed see through storage container for your ROMs which protects them from mechanical and static damage when not in use.
Consider the features:

- Very simple to install, no soldering or modifications to the BBC Micro are required.
- Uses a professional ZERO INSERTION FORCE SOCKET (ZIF) so no force is required changing a ROM.
- No further expense, ROMs are used as supplied without expensive specialised cartridges. The storage box included stores up to 12 ROMs in perfect safety.
- Fits neatly into the existing cartridge slot on the lefthand side of the BBC Micro keyboard.
- The low profile design of the socket gives unrestricted access to the keyboard, unlike other cartridge systems.
- Allows easy installation and changing of Sideways ROMs, all without dismantling your BBC Micro. Once locked in position in the ZIF socket the ROM behaves as a normal sideways ROM.
- No more problems of running out of socket space, simply unplug the ROM and plug a different one in!

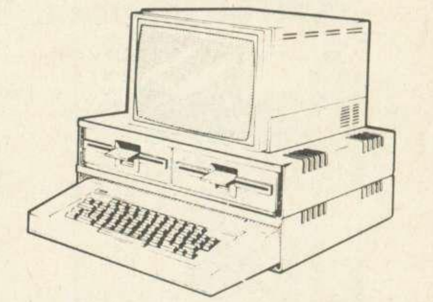
A REAL MUST FOR PROFESSIONALS AND HOBBYISTS ALIKE

ONLY £16

BOOKS (No VAT on Books)

30 Programs – BBC Micro	£3.25
30 Hour BASIC (BBC Micro)	£6.95
35 Education Programs for BBC	£6.95
36 Challenging Games for BBC	£5.95
40 Educational Programs for BBC	£5.95
100 Programs for BBC Micro	£6.95
Cassette version of above	£10.00
6502 Application Book	£11.95
6502 Assembly Language Program	£13.95
6502 Assembly Language Subroutines	£14.25
6502 Machine Code for Beginners	£5.95
6502 Software Design	£10.50
A young persons guide to BBC Basic	£4.50
Advanced Machine Code Technique for BBC	£7.95
Advanced User Guide for BBC Micro	£11.95
Advanced Graphics with BBC	£9.95
Advanced 6502 Interfacing	£10.95
Advanced 6502 Programming	£12.45
Assembly Language Programming on BBC Micro	£7.95
Advanced Programming Techniques for the BBC Micro	£7.95
BBC Basic	£7.95
Assembly Lang. Prog. on BBC	£7.40
BBC BASIC	£5.95
BBC Basic for Beginners	£6.95
BBC DIY Robotics & Sensors	£6.95
BBC Forth	£7.50
BBC Lisp	£7.50
BBC Micro An Expert Guide	£6.95
BBC Micro Book BASIC Sound & Graphics	£7.95
BBC Micro Graphics and Sound	£6.95
BBC Micro Programs in Basic	£5.95
BBC Micro **ROM PAGING** System Explained	£2.00
BBC Micro Revealed	£6.95
BBC Micro Assembly Lang. Prog.	£7.95
BBC Micro Disc Companion	£7.95
BBC Micro in Education	£6.50
Basic Programming on BBC Micro	£5.95
Best of PCW Software (BBC)	£5.95
CP/M Users Guide	£13.95
Creating Adventure Programs on BBC Micros	£6.95
Creative Graphics Cassette (Acornsoft). Has 36 graphics programs	£8.95
Creative graphics on BBC Micro	£7.50
Complete Programmer for BBC	£5.95
DISC FILING SYSTEM (DFS) Operating Manual for BBC	£6.95
Discover BBC Machine Code	£6.95
Discover FORTH	£13.95
DIY Robotics & Sensors with BBC	£6.95
Further Prog. for BBC Micro	£5.95
FORTH Programming	£14.40
Functional Forth for the BBC Micro	£5.95
Games on your BBC Micro	£2.95
Games BBC Computer Can Play	£6.95
Graphs & Charts on BBC Micro	£7.50
Graphic Art for BBC Computer	£5.95
Graphs and Charts (Cassette)	£7.50
Graphics on BBC Micro	£6.95
Hobbit (Book and Cassette)	£14.95
Introducing the BBC Micro	£5.95
Introduction to FORTH	£9.30
Intro to Micro Beginners Book (3 Ed.)	£9.90
Let your BBC teach u to program	£6.45
LISP	£9.25
Logo Programming	£8.95
Mastering VISICALC	£12.45
Mastering CP/M	£13.65
Micros in the Classroom	£4.90
Programming the 6502	£11.95
Programming & Interfacing 6502	£16.00
Programming the BBC Micro	£6.95
PASCAL	£9.25
Programming for Education on BBC	£5.95
Structured Prog. with BBC BASIC	£6.50
The Complete FORTH	£6.95
The BBC Micro Book, BASIC, SOUND & GRAPHICS	£7.40
Using Floppy Discs with BBC Micro	£5.95
Using BBC Basic	£6.95
Using 6502 Ass. Language	£14.50
Wordstar & CP/M made easy	£6.95

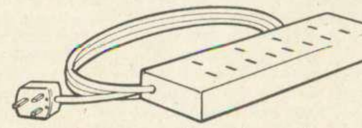
PLINTHS FOR BBC MICRO AND PRINTERS



Protect your computer from the weight and heat of your monitor. BBC micro plinths have slots for maximum ventilation. Single height version is suitable for BBC and monitor. Double height version allows the disc drives to be used in the centre section or stationary, etc. The computer slides easily in to place, allowing easy access to remove the lid.
The printer plinth is equally sturdy but without the cooling slots. This allows the paper to be stacked under the plinth with the printer on top – a very convenient way to work as it does not require the usual very deep table.

SINGLE BBC PLINTH	**£11** (carr. £1.50)
DOUBLE BBC PLINTH	**£20** (carr. £2.00)
PRINTER PLINTH	**10** (carr. £1.50)

4 WAY MAINS DISTRIBUTION SOCKET



4 way top quality mains trailing sockets. Supplied wired up with mains plug ready for use. Can be screwed to floor or wall if required. Very useful for tidying up all the mains leads from your peripherals. Allows the whole system to be switched on from one plug.

£9.50

ASSORTEDCONNECTING LEADS

(All ready made and tested)

CASSETTE LEADS 7 pin DIN Plug	
to 5 pin DIN Plug + 1 Jack Plug	**£2.00**
to 3 pin DIN Plug + 1 Jack Plug	**£2.00**
to 7 pin DIN Plug	**£2.50**
to 3 Jack Plugs	**£2.00**
6 pin DIN to 6 pin DIN Plug (RGB)	**£2.50**
MONITORLEADS	
Microvitec RGB leads 6 pin DIN to 6 pin DIN for colourmonitors	**£2.50**
KAGA/SANYOColourMonitorLeads	**£5.00**
Monochrome monitor leads BNCtoPhono	**£3.00**
DISC DRIVE POWER LEADS	
Supply from BBC power supply to standard Disc Drive connector.	
Single	**£3.00**
Dual	**£3.75**

MISCELLANEOUS CONNECTORS

	Plugs	Sockets
RGB (6 PIN DIN)	30p	45p
RS423 (5 pin Domino)	40p	50p
Cassette (7 pin DIN)	25p	65p
ECONET (5 pin DIN)	20p	30p
Paddles)15 pin 'D')	110p	215p
BBC Power Plug 6 way	80p	–
Disc Drive Plug 4 way	75p	–

ATTACHE CARRYING CASE for BBC Micro

The Attache carrying case is attractively finished in mottled antique brown leatherette. The case is made of tough plywood, providing a very solid and safe way to carry your BBC micro. There is room provided to fit all the leads necessary behind the computer and manuals in the front. Locks supplied with two keys. Price **£12** (£2 carr.)

VOLTMACE DELTA 14 JOYSTICK SYSTEM

The Voltmace system provides full facilities for connecting the Delta 14 handset.
Delta 14 handset – On its own makes a high quality centre sprung analogue joystick with fire buttons **£12.50**
Adaptor Module allows use of two joysticks and provides hardware to access all the keys on the keypad of the joystick **£12.55**
Transfer program allows use of the keypad keys and joystick to simulate any key on the keyboard. This works by creating a machine code patch that stays in memory while another program is loaded in. Allows any game to be used with joysticks. Supplied on disc or tape.

Tape **£5.10**
Disc **£7.95**

STANDARD JOYSTICKS

These are standard analogue type with a fire button on each joystick. Twin joysticks go to a single moulded plug, long leads provided.

Single Player version **£7.00**
Two Players version **£12.00**

GAMES SOFTWARE

ADVENTURE QUEST (L.9)	£8.50
COLOSSAL ADVENTURE (L.9)	£8.65
CHESS	£6.95
CHUCKIE EGG	£7.90
CRAWLER (WESOFT)	£5.00
CROACKER	£6.95
DUNGEON ADVENTURE (L.9)	£8.50
Escape from MOONBASE ALPHA	£6.95
FELIX in the FACTORY	£6.95
GALACTIC COMMANDER	£6.95
KILLER GORILLA	£6.95
MUNCHYMAN	£5.95
MOONRAIDER	£6.95
MUSIC SYNTHESISER	£8.25
PENGO (Watford)	£5.95
SNOWBALL (L.9)	£8.50
SWOOP	£6.95
Twin Kingdom Valley	£8.25
747 FLIGHT SIMULATOR	£7.75

CRAWLER

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NOW IT'S IN THE CAN

Your graphics program comes to life – and death – as Tessie Revivis sets up the roving fly for the kill

LAST month in First Byte we used an asterisk to represent a moving fly in a simple buzzing game. Now we'll make our fly a little more realistic and put some action into the game by introducing a can of lethal fly spray.

The Electron has its own designing command, which allows the user to program a shape into a character so that it can be printed onto the screen in much the same way as our common or garden asterisk. The command is VDU23. But first we must design our fly.

To do this we use a sheet of paper marked into squares eight wide by eight deep. A suitable character planning sheet can be found on page 287 of the *Electron User Guide* (page 496 in the Beeb *User Guide*). The character itself is designed by filling in suitably positioned squares. Figure 1 shows my own effort at designing the fly – I hope you see some resemblance.

Once the character has been designed it has to be converted into a form that the Electron can understand; as it's a computer that means numbers. If you study figure 1 you'll see that each column is assigned a value, termed its 'weight', starting with 1 on the right and then doubling as you move left along the columns. To convert the character into a computer-recognisable form each 'row' is turned into a numeric value by adding the weight of each column that contains a coloured square.

This process is shown in the figures to the right of the diagram, but just to make sure it is clear in your mind let's consider the top row. If we think of a clear square as a 0 and a coloured square as a 1 the top row can be represented as 00100100. The ones are often referred to as bits, so we can say that the two 'set' bits are in the 32 and 4 column. Adding these two together gives 36, thus the computer representation of the top row of the fly character is 36.



Each of the remaining rows is treated in the same way, the net result being eight numbers.

Before working these eight values into the VDU23 statement we must decide which of the user-definable characters we wish to use to represent the fly. The basic set of user-definable characters are the ASCII characters 224 through to 255, so we can use any of these. Let's use the first ASCII character 224. Constructing the VDU23 statement is simple enough. It must be followed by the character code and then the eight definition values starting with the top one, each being separated by a comma. So the final statement looks like this:

```
VDU23,224,36,24,90,189,255,60,24,36
```

A simple two-line program shows how the fly can be printed onto a mode 4 graphics screen:

```
10 MODE 4
20 PRINT TAB (10,10); CHR$224
```

As the fly forms part of the ASCII character set it can be printed on the screen using the CHR$ function, as illustrated in line 20 above.

Designing a fly spray can proceed in much the same way. The can will obviously need to be much larger than the fly but, as we have seen, the VDU23 command allows only set-sized characters. This can be overcome simply by using several character definitions together. For example, if we plan to start the fly spray can at character 225 and make it two characters wide

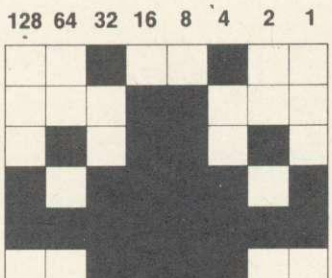


by three deep its layout might look like figure 2. The design of the spray can is done in sections and the complete picture produced by printing the correct sequence of characters using the PRINT TAB commands.

Figure 3 shows the top of the can designed across two character planning sheets. Calculating the numeric value is done as described above for each planning sheet. The complete definition need be only four VDU23 commands in length as the second and third rows can be identical, unless you fancy adding a base to the can or something extra that would make the third set of characters different.

The following short program illustrates how the can can be printed on the right-hand side of the screen.





32 + 4	= 36
16 + 8	= 24
64 + 16 + 8 + 2	= 90
128 + 32 + 16 + 8 + 4 + 1	=189
128 + 64 + 32 + 16 + 8 + 4 + 2 + 1	=255
32 + 16 + 8 + 4	= 60
16 + 8	= 24
32 + 4	= 36

Figure 1. The fly is drawn on an 8 × 8 grid, each column of which is given a 'weight' (top row of figures). Each row is given a numeric value by adding the weights of each filled square (right-hand column) and a series of figures is produced that the computer can interpret.

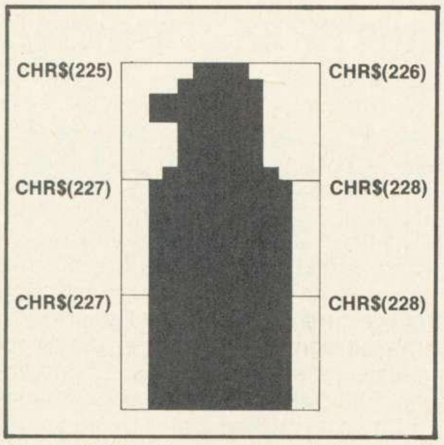


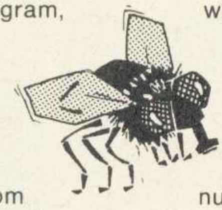
Figure 2. The fly spray can, being much bigger, cannot be represented on one 8 × 8 grid so it assembled from six 'characters'.

```
10 MODE 4
20 VDU23, 225, 3, 7, 31, 31, 7, 7, 7, 15
30 VDU23, 226, 192, 224, 224, 224, 224,
   224, 224, 240
40 VDU23, 227, 31, 63, 63, 63, 63, 63,
   63, 63
50 VDU23, 228, 248, 248, 248, 248, 248,
   248, 248, 248
60 PRINT TAB (30, 2); CHR$(225);
   CHR$(226)
70 PRINT TAB (30, 3); CHR$(227);
   CHR$(228)
80 PRINT TAB (30, 4); CHR$(227);
   CHR$(228)
```



The second of the TAB coordinates, the Y value, is simply incremented by one to ensure that the next pair of characters is printed below.

The animation part of the program is set in two stages: moving the fly to and fro across the screen and moving the spray can up and down the right-hand side of the screen. Moving the fly across the screen was discussed last month and indeed there are few changes from that section of the program, PROCfly. However, rather than moving the fly along a straight path an extra line (line 105) has been inserted into the procedure that will cause the fly to move up and down slightly as it proceeds across the screen. This is produced by adding a random number generating command to determine the Y tab position within a set range. The command is RND and this is followed by a value, 7 in the program, which causes a random number in the range 1 to 7 to be 'found'.



As we do not wish the fly to move too near the top of the screen 2 is added to this value, thus ensuring a random value in the range 3 to 10.

Creating movement with the fly spray can is done in much the same way except that movement is on the Y axis. Two keys are used by PROCfly to see if this is required, the up arrow to move the can up, and the down arrow to move it down. Normally these two keys will not return a value when tested with the INKEY$ command, however, you can force them to return ASCII values by first turning them on using a *FX4, 1 command (line 505 in PROCsetup). The ASCII codes produced by these two keys are 138 and 139 and these are tested for by lines 140 and 145 in PROCfly. If either is detected the appropriate can-moving procedure is called.

To swat the fly it must be sprayed with a cloud of the killer potion. Once the can has been moved into position the space bar will press the top, the fly will freeze in fright as the spray cloud is propelled across the screen. If the fly is in the line of fire then it crashes to the floor with a thud – otherwise it lives to fight another day.

To see just how good you are a record of the number of sprays you use is kept at the bottom of the screen.

For the main listing, which is fully annotated, turn to yellow page 97. Study this and refer to your *User Guide* to find out more on the commands being used in each section. Then you might feel up to adding a couple more flies and perhaps even a mobile strip of fly paper.

If you think your fly program is better than mine send it in to *Acorn User*. We'll pay £20 for the best fly game we publish.



The annotated 'Flies 2' program is listed on yellow pages 97/98

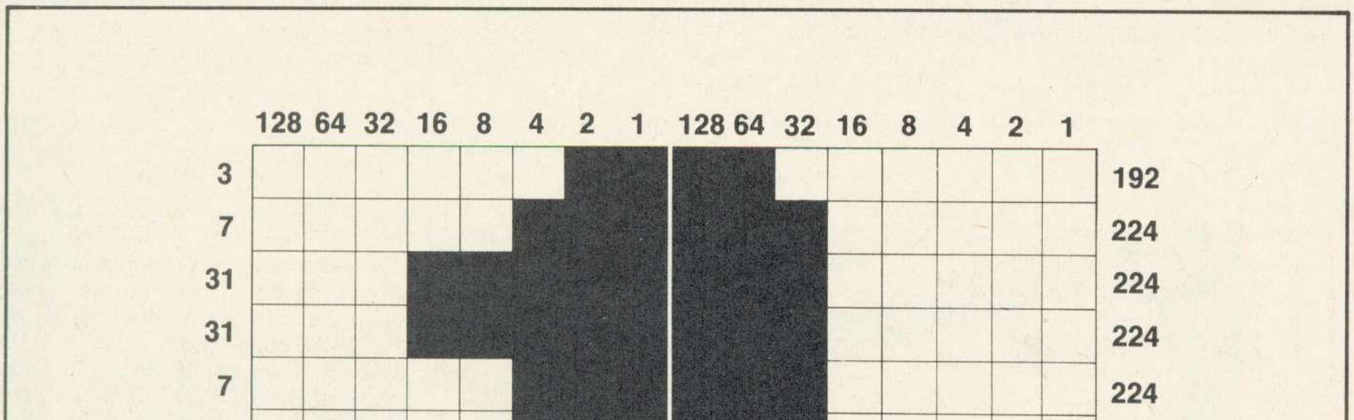


Figure 3. Detail of the can showing the top put together from two adjacent characters

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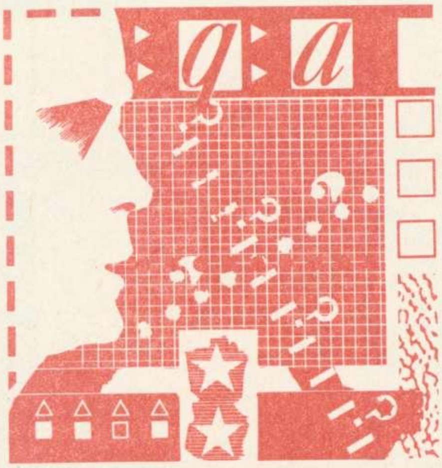
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Martin Phillips answers your queries on two-up printing, a 'freezing' screen, text and title display and the envelope statement

Dot and daisy at the same time?

IS there any way of having a dot matrix printer and a daisywheel printer connected to a micro at the same time through the parallel printer port? This question was put to me by H L Malhotra of Radlett.

Indeed it is possible, and Keyzone of Unit 4, Regeneration House, School Road, Park Royal, London NW10 (tel: 01-965 1684/1804) makes a printer-changer designed to connect two or three printers to one micro. The device costs about £75.

Mr Malhotra would also like to know if his Watford disc filing system (DFS) will work with a second processor (6502 or Z80). New ROMs are provided with both second processors. For the 6502 second processor one is a new version of Basic and the second is a combined DFS and Econet Filing System (NFS). These two ROMs are installed in the BBC's sideways ROM sockets. The existing DFS needs to be removed and be replaced by the new one, but the new Basic ROM can be added without removing the existing Basic. For the Z80 a single new ROM is provided. This is the combined DFS and Econet ROM and the existing DFS needs to be removed.

Outmoded system in operation

B J WOOLNOUGH, who lives in Jeddah, has an Acornsoft program that will not run on his BBC computer, although it runs perfectly well on another machine. On Mr Woolnough's micro the display 'freezes' after a short time and will not respond to the keyboard. It happens only with this program.

The problem, I suspect, is the operating system in his BBC. Many software houses are now producing software that will run only with the 1.2 operating system (1.2 OS). Early BBC machines were sold with a 0.1 OS, which had fewer features than the current one. If the software was designed to run with the 1.2 OS, it probably won't work correctly with the older 0.1 OS fitted. My advice to anyone still using an 0.1 OS is to return it to the Acorn dealer and have it replaced by the 1.2 OS. The cost is a little over £10.

To test which operating system is fitted, type *FX0 and press RETURN. A message will appear that will give the answer. A few of the first machines fitted with the disc or Econet filing systems were fitted with a 1.0 OS. This is almost the same as the 1.2 OS, but not quite, and if similar problems are experienced it would be worth getting it changed.

£5 Text scrolling in a window

THE following problem was encountered by Mr Macdonald of Stornaway when he was writing an index file for his cassettes.

He wanted mode 7; he wanted to reserve the top four lines to display a title; he wanted to reserve the bottom four lines for instructions; and he wanted the remaining lines to be used to display information and to be able to scroll without corrupting the title or the instructions.

It is useful to receive such an explicit request, and I'm sure this is a program that many will be able to put to good use. Mr Macdonald's requirements can be fulfilled by using a text window after printing the title and instructions. At the same time it is possible to alter the background and foreground colours and incorporate other teletext codes to the left of the text window so that they will not be overwritten.

Listing 1 shows the technique. There are two procedures. PROCsetup contains the title strings and the four strings of instructions. PROCscreen is the procedure that performs the screen layout. Lines 180 to 220 set up the first four lines and print the title in double height. The background colour is blue (CHR$132), and the foreground colour is cyan (CHR$134). CHR$157 changes the background colour, and CHR$141 gives double-height printing. Line 200 adds extra spaces to the title to centre it.

Lines 230 to 250 similarly set the background colour to blue and the foreground colour to white for the middle

```
 10 REM Listing 1
 20 MODE7
 30 PROCsetup
 40 PROCscreen
 50 END
 60 :
 70 DEFPROCsetup
 80 DIM title$(1),instr$(3)
 90 title$(0)="Title line 1"
100 title$(1)="Title line 2"
110 instr$(0)="1st line of
    instructions."
120 instr$(1)="2nd line of
    instructions."
130 instr$(2)="3rd line of
    instructions."
140 instr$(3)="4th line of
    instructions."
150 ENDPROC
160 :
170 DEFPROCscreen
180 FOR N=0 TO 3
190 PRINTCHR$132 CHR$157 CHR$141
    CHR$134;
200 PRINTSPC(16-LEN(title$(N/2))
    /2);
210 PRINTtitle$(N/2)
220 NEXT N
230 FOR N=0 TO 15
240 PRINTCHR$132 CHR$157 CHR$135
250 NEXT N
260 FOR N=0 TO 3
270 PRINTCHR$132 CHR$157 CHR$134;
280 PRINTinstr$(N);
290 IF N<3 PRINT
300 NEXT N
310 VDU28,3,19,39,4,14
320 ENDPROC
```

Listing 1. For the Beeb, text scrolling in a window, with title above and instructions below

IF YOU have a technical hitch or a programming problem let Martin Phillips give his diagnosis. We'll pay £5 if you raise a really interesting point. Please give full details of the system you're using and include a listing where appropriate, making your question as specific as possible. WRITE TO: Hints & Tips, Acorn User, Redwood Publishing, 68 Long Acre, London WC2E 9JH.

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```
 10 REM Listing 2
 20 MODE1
 30 PROCsetup
 40 PROCscreen
 50 END
 60 :
 70 DEFPROCsetup
 80 DIM title$(1),instr$(3)
 90 title$(0)="Title line 1"
100 title$(1)="Title line 2"
110 instr$(0)="1st line of
    instructions."
120 instr$(1)="2nd line of
    instructions."
130 instr$(2)="3rd line of
    instructions."
140 instr$(3)="4th line of
    instructions."
150 VDU19,0,4,0,0,0:REM Blue
    background
160 VDU19,2,6,0,0,0:REM Colour
    2 - cyan
170 ENDPROC
180 :
190 DEFPROCscreen
200 COLOUR 3
210 FOR T=0 TO 1
220 x=20-LEN(title$(T))/2
230 PROCdouble(title$(T),x,T*2)
240 NEXT T
250 COLOUR 1
260 PRINTTAB(0,28);
270 FOR N=0 TO 3
280 PRINTinstr$(N);
290 IF N<3 PRINT
300 NEXT N
310 VDU28,0,27,39,4,14
320 COLOUR 3
330 ENDPROC
340 :
350 DEFPROCdouble(A$,x,y)
360 X%=0:Y%=13:A%=10:D=&D00
370 C$=CHR$(240)+CHR$8+CHR$10+
    CHR$(241)
380 FOR N=1 TO LEN(A$)
390 B$=MID$(A$,N,1):?D=ASC(B$):
    CALL&FFF1
400 VDU23,240,D?1,D?1,D?2,D?2,
    D?3,D?3,D?4,D?4
410 VDU23,241,D?5,D?5,D?6,D?6,
    D?7,D?7,D?8,D?8
420 PRINT TAB(x+N-1,y)C$:NEXT
    N
430 ENDPROC
```

Listing 2. Modified version of listing 1 for Electron owners

lines, which will be the scrolling window. Lines 260 to 300 print out the four instruction lines at the bottom of the screen. The background colour is set to blue and the foreground colour to cyan.

Line 290 is used to start a new line after each line of instructions except the last. This line appears at the bottom of the screen, and if the cursor goes to the next line the screen will scroll, losing the top title line.

Line 310 is the key to the whole program. It defines a text window in the middle of the screen four spaces in from the left to avoid the teletext characters placed down the left-hand three columns. VDU14 puts the text window into paged mode so that the screen will scroll only when the shift key is pressed. Once the program has run, list it to see the effect. Title and instructions will remain in place while the rest of the program scrolls.

The colours can be changed by changing the teletext colour codes. You don't have to type in the CHR$132 etc each time. Instead if the shift key and (in this case) function key f4 is pressed, it will give the blue character control code. This feature of the function keys is present only on a BBC with the 1.2 OS and not the Electron. It will not show up on printed out listings so the CHR$ alternative has been used for the printout.

Red	CHR$129	SHIFT/f1
Green	CHR$130	SHIFT/f2
Yellow	CHR$131	SHIFT/f3
Blue	CHR$132	SHIFT/f4
Magenta	CHR$133	SHIFT/f5
Cyan	CHR$134	SHIFT/f6
White	CHR$135	SHIFT/f6

When typing in this program, you must ensure that all punctuation marks are exactly as in the listing or some odd effects will appear on the screen. The display could consist of a series of black and white stripes, for instance, or the title or instructions could be lost. Readers interested in using text windows are reminded that this subject also occurred in the July Hints & Tips.

For Electron owners, a similar program (Listing 2) is included which uses mode 1 instead of mode 7 and the double-height procedure described elsewhere in this section.

Envelope generators

SEVERAL readers have been trying to unravel the mysteries of the BBC's or Electron's sound system. The thing that most find confusing is the ENVELOPE statement. This statement is followed by 14 parameters, and trying all the

page 54▶

Off-the-shelf procedures

FOR several years I've been saying to myself that I must build up a library of simple procedures that I can quickly *EXEC onto the end of an existing program to save typing time. I still have not achieved this. I've included procedures in this column that can be used in such a way but it would be nice to receive short procedures that readers find useful when programming. Perhaps we could then assemble a library of these for publication and inclusion on the monthly cassette.

One procedure I use frequently is a double-height printing routine that works in any of the BBC or Electron's graphics modes. This is shown in listing 3. Once the procedure has been typed in it should be saved by typing *SPOOL "DOUBLE" and pressing RETURN. Then type list and the procedure will be transferred to tape or disc under the filename DOUBLE. To complete the process type *SPOOL again and press RETURN. This then closes the *SPOOL file.

To show how the procedure can then be incorporated into a program type in the following short program:

```
10 REM Program to demonstrate
   double height procedure
20 MODE 1
30 PROCdouble ("This is DOUBLE
   height", 9, 5)
40 END
50 :
```

Then load in the procedure by typing *EXEC "DOUBLE" and pressing return. The procedure should load in line-by-line and at the end will give an error message. Don't worry, that is normal. Now list the program and the procedure will be added to the end of the listing. When the program is run the message should be printed in the middle of the screen five lines down from the top in double-height lettering.

The use of this procedure is also demonstrated in listings 2 and 4.

```
   10 REM listing 3
   20 REM Do'not spool these two lines!
20000 DEFPROCdouble(A$,x,y)
20010 X%=0:Y%=13:A%=10:D=&D00
20020 C$=CHR$(240)+CHR$8+CHR$10+CHR$(241)
20030 FOR N=1 TO LEN(A$)
20040 B$=MID$(A$,N,1):?D=ASC(B$):CALL&FFF1
20050 VDU23,240,D?1,D?1,D?2,D?2,D?3,D?3,D?4,D?4
20060 VDU23,241,D?5,D?5,D?6,D?6,D?7,D?7,D?8,D?8
20070 PRINT TAB(x+N-1,y)C$:NEXT N:ENDPROC
```

Listing 3. Double-height printing in any of the BBC and Electron's graphic modes

combinations of these parameters is a slow and laborious task. It can be greatly simplified by using an envelope generator. This is a simple program that allows the parameters to be quickly and easily changed and the sound of the new envelope heard.

Two simple envelope generators are included this month. Listing 4 is an envelope generator for the BBC and listing 5 a simpler version for use on the Electron. The Electron doesn't have the full ENVELOPE statement and so needs a different program, although the full BBC version will run on the Electron.

The program is quite straightforward to use and understand, although it is worth reading the 'sound' chapter in the *User Guide* first. When an interesting sound is heard it is worth recording the parameters and a brief description of the sound. A collection of sound effects is useful when writing programs. Again, I would be interested to hear from readers who have discovered useful envelopes. Remember that an envelope will sound right only over a limited range of the pitch parameter, and this too should be varied to hear different effects.

See page 99 for listings 4 and 5

REMinder

WHEN de-bugging programs you often have to delete lines that are causing trouble. The easiest way to do this without forgetting the contents of the line is to edit the line, put a REM statement directly after the line number and then copy the rest of the line. Now when the program is run the rest of the line will be ignored once the REM statement is encountered. If the line is to be included again, the REM statement need only be deleted.

Word-blocked

MR KELLER of Weybridge has his BBC and *View* wordprocessor fitted up to a Silver Reed EX44 typewriter. When he tries to print out the text that he has saved on a cassette recorder the 'Block' error appears on the screen after a few lines. Mr Keller wonders if he needs a printer driver to cure the problem.

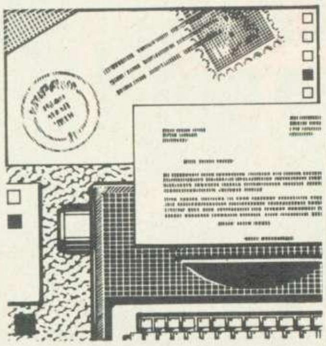
The answer is simple – use a cassette recorder with a motor control fitted. What is happening is that the printer is taking so long to print out the first block of text saved on tape that by the time it is ready for the next block, the cassette had played on and was at the wrong block. With a motor control fitted, the cassette stops after the first block and restarts when the printer is ready for the next block.

Menu amendment

IN MAY's Hints & Tips a simple disc menu program was printed. A problem can occur with this menu if it is used to *LOAD a program that resides in a different place in memory from normal. What happens is that after loading the appropriate program the menu program will move onto the next line and load the following program too. To avoid this, insert a line after the offending line to end the program. Eg:

```
490 CHAIN"PROG1"
500 *LOAD"PROG2"3000
505 END
510 CHAIN"PROG3"
```

Notice that the line number ends in a 5 so that it doesn't upset the computed GOTO in line 390



Clearing up queries on second processor

Sir, I am writing in response to the letter from I Crawford in your August edition concerning his 'problems' with the 6502 second processor. It seems to me he has not understood what happens when using a second processor.

The 6502 is an eight-bit processor and because of this can address 64k directly. As a result, any languages or machine code programs have to run in the second processor, hence the need to copy them across from the input/output processor (in this case the BBC micro). Some of the memory in the second processor is used to hold operating system software at location &F800. On start-up the default language is copied across the Tube to the same memory position as it occupied in the I/O processor – but this time in the memory space of the second processor.

HiBasic is a relocated version of Basic II and resides in the second processor at location &B800, giving approximately 44k for Basic programs. For machine code programs, 61k is available since the memory occupied by Basic and its workspace may be used.

Also with a second processor, HIMEM remains fixed at &8000 regardless of mode, since the screen is mapped into the I/O processor and not the second processor. Memory in the I/O processor that is not being used for display purposes can still be used – effectively by poking and peeking. This may be done using operating system calls as defined in the *User Guide* and *Advanced User Guide*. It is also possible to execute code in the I/O processor from the second processor.

Now to I Crawford's questions.

When using HiBasic the gain made is the memory below the operating system and above the default language location (ie, the location Basic occupies in an ordinary machine), this being about 14k.

When the machine is switched on, Basic is copied across to the second processor and any programs loaded will be run here. The original memory is now used only for display purposes. Part of this memory (depending of course on mode) may be used by peeking and poking via the correct operating system calls, but cannot be reclaimed.

As far as ROMs are concerned, all Acornsoft's will work across the Tube. Wordwise will not work because it pokes directly to the screen. The same is true for any ROM which pokes the screen directly.

I hope this clears up some of the problems and that my comments will be of use to potential purchasers of a second 6502. **Gary Jones**
Manchester

Reviewers need to compare products

Sir, As one who is involved with the BBC micro, both personally and professionally as a teacher, I must compliment you on the new format of your magazine, particularly the idea of compacting the listings into a separate section of the magazine. There seems, too, to be a greater variety of articles, and diversity of sections.

I find your magazine a tremendous reference point for new software that may be of interest to me at home, and for new developments in the field of education.

With particular reference to the educational software or developments in hardware I find it difficult to evaluate new material and have to rely on publications that concern themselves either with the BBC computer or with educational computing. I have found your reviews objective and fair, but could they be more comparative?

I suggest this because I do not have the facilities to compare new software, making a realistic judgment more difficult. Software houses are still reluctant to supply local authority education computer centres with software free for evaluation.

To take a case in point, this month (July issue) you reviewed *Edfax*. How much more relevant and useful it would have been if you had been able to take 'viewdata systems' as a theme and to compare the software available. *Edfax* certainly has strengths, but what are the qualities of Optima's *Datext* or Datapen's *Teletext Display Creator*. My own experience would put *Datext*'s move, copy, cycling options in a different league to those of *Edfax*, yet *Edfax*'s use of function keys is clearly more friendly. At the same time, the documentation of *Edfax* is extensive, that of *Datext* restricted to a fold-up pamphlet!

Similarly, there has been a need for a comprehensive database for schools that is menu-driven and accesses the disc rather than being an enhanced cassette version. Suddenly, they appear to be available in plenty, but again how can you evaluate them without purchasing each one?

I do not feel that I am a lone voice crying in the wilderness, there must be many 'non-experts' like myself in primary schools up and down the country who seek opportunities for evaluation of new materials. Schools do not have the money to make errors over choice of software.

David Powell
Rotherham

We couldn't agree with you more, and have already begun the task you suggest. The review, with bench tests, of four monitors in June's issue was very popular and in this issue we cover Basic toolbox ROMs (page 157).

To say these reviews are strictly comparative would be wrong, but they aim to give a series of test criteria that readers can apply for themselves. Already, there are dozens of databases and wordprocessors, making detailed comparison difficult. However, our reviews should enable you to decide what facilities you need and to make your choice. As you point out, most have strengths and weaknesses, and the opinions of a reviewer may not tally with yours.

In the next few months we shall consider databases, wordprocessors, machine code utilities, lightpens and joysticks. In November's issue, six turtles and buggies are put under scrutiny. Please let us have your comments.

Bar codes in Acorn User

Sir, May I comment on a news item in the August issue of *Acorn User*, which said that Wordsmiths of Somerset were the first company to offer a professional typesetting service to Wordwise users. We have been offering this service for 12 months, having done work for, among others, Computer Concepts themselves (Disc Doctor manual) and more recently Clares Micro Systems (Beta Base manual).

We are also co-operating with John Coll and Mike Bostock of MEP in generating high-quality bar codes for their bar code reader. I believe *Acorn User* is to be the first magazine to publish bar code programs. We can generate typeset bar codes directly from a cassette/disc program or messages from Wordwise, etc. In fact, our service extends beyond Wordwise and we believe we are able to typeset directly from most BBC wordprocessors – including Wordwise, View and Wordsworth. An information booklet explaining our coding system is available.

Our ability to typeset from various disc formats enables us to offer an additional data conversion service of transferring data between different types of disc, ie accept a BBC disc and transfer the data to a Tandy 80, or Epson to a Torch, or Apple to a Sharp etc. This data conversion service normally involves a basic handling charge plus 25p per thousand for the first 500,000 characters and 20p per thousand for the remaining characters. **Ray Lumb**
Quorum Technical Services
Sandford Park Trading Estate
Corpus Street
Cheltenham
Gloucs GL52 6XH

We don't think *Acorn User* will be the first magazine to publish bar code listings (*Byte* did it a few years ago in the US), but we are supporting the MEP with its project which will be launched in October.

Addison Wesley will be releasing the reader with software and documentation, while *Acorn User* will explain the ideas involved, and make software available in bar code format.

So, interested parties should keep their eyes peeled!

Searching for robot projects

Sir, After seeing the BBC TV series 'Computers in Control', I am interested in the Fischertechnik models. How do I link them to my BBC micro?

Also, has anyone published any books on home-made robots?

Paul Dormer
Cheshire

There is a Fishertechnik robot kit which can be made up into six variants: a telescopic arm; graphics tablet; sorting machine; crane; plotter; and solar tracker. It costs £92 and links to the BBC through the user and analogue ports. Simple software is included.

The list is available from Micro Robotic Systems. 20 Penywern Rd, London SW5 9SU.

There is a magazine called *Practical Robotics*, and *Electronics and Computing Monthly* often carries articles on robots. Next month's *Acorn User* features a review of six turtle and buggy-type robots, with more on robotics to come in the New Year.

QL chance

Sir, The announcement that Acorn has obtained a renewal of the BBC contract for four years will be generally welcomed in our schools and colleges. This continuity should provide a much-needed element of stability in a field where there is, all too often, change for the sake of change, or so it appears.

Meanwhile, the fact that Sir Clive has, not for the first time, missed not only the Bus but also the Tube could allow more time for development of the QL as a genuine competitor to the Beeb.

Kenneth Swinburne
St James's University Hospital
Leeds

Joystick aid

Sir, I would be grateful if you could list the ADVAL commands that detect joystick movement in all directions as the 'Useless Guide', sorry, *User Guide* does not list them!

Robin Sasson
Slough

We think you're being a bit harsh on the User Guide, but here's the information.

ADVAL (1) and ADVAL (2) are used to detect movement on one joystick and ADVAL (3) and ADVAL (4) on the other. ADVAL (1) and ADVAL (3) detect left-right movement, returning a low number when the joystick is right, and a high number when the joystick is across to the left. ADVAL (2) and ADVAL (4) return a low number when the joystick is back and a high number when the joystick is forwards. The number returned is in the range 0 to 65520.

Analogue joysticks will return a value even if the joystick is not being moved, the number returned indicating the position of the joysticks.

Elk insanity

Sir, I've been reading *Acorn User* for over a year now. It has always been an excellent publication and with the new printing format it's near perfect.

I say 'near perfect' because one thing is driving me mad! You keep on referring to Electron as an ELK (ugh!).

What idiot made that name up? It brings Acorn down to Sinclair standards. It even sounds like a Sinclair add-on!

So please, please help me keep my sanity. Call the Electron an Electron.

Jason Cann
Cardiff

Odd character

Sir, Congratulations on the recent improvements to *Acorn User*. I have a frustrating problem which I wonder if you could solve. What does *¦ do! No error message is given and the filing system is not accessed.

Clive Maidment
Middx

The '¦' character has a special meaning to the operating system. '¦A' represents control A, '¦B' represents control B and so on. Its main use is to allow the placing of control codes in a function key definition, notably ¦M representing a carriage return. It can be used with all the operating system commands, so a file can be saved with the name '¦L' (clear screen code) resulting in the screen being cleared each time you get a directory.

The particular code you mention doesn't really do anything as it is incomplete.

Third 'first'

Sir, I am writing in response to a news item that appeared on page 22 in the May edition of *Acorn User*. The headline read 'Salamander first with m/c compiler', but I rather doubt that this is true. Jeremy Ruston produced a compiler that was marketed in 1983, and in January of this year we marketed a compiler written by Simon Parker. Our compiler comes on cassette for £17.95 or disc for £19.95, and is advertised in your magazine every two months. More than 50 BBC Basic keywords are catered for.

So it would appear that Salamander's compiler was in fact the third.

M Towle
ACK Data
21 Salcombe Drive
Nottingham
NG5 8JF

Keyboard query

Sir, I have three questions on BBC Basic. First, how do you clear the keyboard buffer? Second, how do you mix colours in user-defined graphics? Finally, what is the teletext control code for separated graphics, as in the title page on Acornsoft's programs for the BBC micro?

Timothy Lennon
Somerset

Here come the replies, in order. *FX15,0 will clear all the internal buffers, and *FX21,0 flushes the keyboard buffer. Further information on these calls can be found in chapter 42 of the BBC and Electron user guides, and in the *Advanced User Guide*.

In the September issue, Harry Sinclair showed how to produce full colour sprites. Also if you are printing at the graphics cursor (after VDU 5) then only points that are in the foreground colour are plotted, those pixels which are in the background colour are not so colours can be mixed by printing at the same position with different characters in different colours.

Finally, the teletext code for separated graphics is 154; it is turned off by code 153. All the teletext control codes are in the BBC User Guide on pages 486 to 489.

Unilab contact

Sir, I have already written in for details of the weather satellite project in August's magazine, but could you please let me have an address for information on the Unilab computer interface.

Jason Bryant
Gwent

The address for Unilab is: Clarendon Rd, Blackburn BB1 9TA.

Latest round-up of games high scores

Aviator	Acornsoft	450	**Mark Bradshaw**
Android Attack	Computer Concepts	602,590	**Stephen Green**
Arcadians	Acornsoft	48,760	**Gerard Mulholland**
Battletank	Superior	16,320	**Damon Futter**
Chuckie Egg	A&F	1,997,800	**Gerard Mulholland**
Crazy Painter	Acornsoft	13,700	**Derek McDowell**
Cybertron Mission	Micro Power	26,460	**Mark Bradshaw**
Fortress	Pace	87,000	**Damon Futter**
Free Fall	Acornsoft	1,188	**Owain Griffiths**
JCB Digger	Acornsoft	52,000	**Owain Griffiths**
Killer Gorilla	Micro Power	63,900	**Mark Bradshaw**
Meteors	Acornsoft	73,220	**Robert Hirskyj**
Missile Command	Gemini	25,905	**Mark Bradshaw**
Monsters	Acornsoft	19,270	**Owain Griffiths**
Moonraider	Micro Power	320,000	**Damon Futter**
Overdrive (BBC)	Superior	102,560	**Daryl McClure**
Overdrive (Electron)	Superior	707,010	**Gerard Mulholland**
Painter	A&F	104,820	**Mark Bradshaw**
Pengo	Watford	173,000	**Damon Futter**
Planetoids	Acornsoft	488,900	**Robert Hirskyj**
Rocket Raid	Acornsoft	61,560	**Robert Hirskyj**
Snapper	Acornsoft	168,970	**Mark Bradshaw**
Space Adventure	Virgin	4,640	**Gareth Dykes**
Zalaga	Aardvark	171,430	**Daryl McClure**

Breaking the barrier

Sir, While playing around at my Beeb I discovered a way of program protection, quite by accident. I typed in:

```
*KEY 10 A$=GET$:M CLS:M
```

When typed in, any program already in the computer could not be tested and break would cause a 'Bad program' message to appear. I found this very interesting as I had not seen such a simple procedure as this before. I would like to know why this happens.

D Wolff
Llannelli

To understand why this works you must know a little about where the Beeb stores a Basic program and where it stores variables. Normally variables are stored in memory after the end of your program, the value of this location is held in the variable LOMEN.

When the Break key is pressed the old value of LOMEN is lost (OLD resets it), and it is set up with the value &1900, which is where Basic stores your program. So if before you OLD, you set up any variables they will overwrite the beginning of your program. You have programmed the Break key to set up a variable, this corrupts the beginning of your program, and hence a 'Bad program' error when you try to OLD.

If you only do a CTRL-Break then a program can still be recovered by typing 'OLD'.

Fortress cure

Sir, I had the same problems as your reviewer in running Amcom's *Fortress* (September), namely that, after the first three lives, the machine locks up solid, switching off being the only solution.

The solution turned out to be simple. Once the program is loaded, and *before* the craft is crashed, hit the escape key. This works for myself every time, and was discovered thanks to Reed Photography of Chesham.

Whether this is the fault of the machine (an Issue 3 board) or the superbly protected software could be debated until the cows come home. The moral of the story? First, don't panic; second, find someone who has played it before and watch them like a hawk!

Before I get condemned to Mad Alex's dungeon for life, dare I ask when *Acorn User* is going to review Skywave's Multi-Tasking Forth-83?

A Binns
Amersham

Thanks for the tip, and the Skywave review is underway.

Shinwa tip

Sir, I am writing with reference to the multi-tone screen dump presented in the July issue of *Acorn User*, for Epson-type printers. A simple way to alter the program to produce a proportional dump on a Shinwa CP80 printer (provided the occasional lost byte is not important), is to amend the following two lines:

```
180 VDU1,27,75,1,0,1,2
710.print_bytes 1dx #1
```

Great magazine!

Stephen Wilcock
Bristol

Electron games

Sir, Your Electron readers might like to know about some BBC programs that will run on the Elk. Versions of *Aviator*, *Arcadians*, *3D Bomb Alley*, *Saloon Sally* and *The Mine* all worked when I tested them, although the sound effects aren't as good. Also *3D Bomb Alley*, *Saloon Sally* and *The Mine* are all slower, but in some circumstances *Arcadians* is faster!

Keep producing the magazine by which all others are measured.

N Wright
Lincs

Flashback

Sir, What on earth has the he/she/it silver painted graffiti'd asymmetrical-eyebrowed creature in a government surplus naval gunner's anti-flash hat got to do with computing?

R Taylor
Gwynedd

ASK a silly question, pass a fair comment, stage an angry protest – we don't mind what you write to us about (or about us!). Keep 'em short, keep 'em sweet, but keep 'em coming! The address is: Letters, Acorn User, Redwood Publishing, 68 Long Acre, London WC2E 9JH.

Kitty explains how to choose software and unravels ROMs



Q I've been very disappointed with some of the programs I've bought. What tips can you give to stop me making the same mistakes again? **Peter Brown** Liverpool

A Buying software is just like buying any product, for example a book, and you should look at the task in the same light.

Personal recommendation is the most reliable method, and then there are reviews. As with book reviews, you will learn to trust some people and magazines more than others. Look out in *Acorn User* for a series of comparative reviews where the major criteria in picking a particular type of software will be considered. We covered monitors in June, and this month it's Basic utility ROMs.

Make sure you know what machine you have (especially if it's an upgraded model A). Don't assume a program will work, and, of course, programs labelled for other types of computers will not work. Although the Beeb and Electron are similar, don't buy Electron software for the BBC and vice-versa, unless the seller can show it works on your machine.

Before you buy, ask for a demonstration in your local dealer's or shop. If they won't help, then go elsewhere. Build up a relationship with a dealer who will often be able to recommend software as he/she gets to know your tastes.

Packaging and documentation will be a good indication of quality and will be important to some people, but not others. Look out for screen shots, which many software houses are showing as standard on cassette boxes. Make sure the company prints an address for return if the program doesn't work, or that the shop will exchange.

Some shops will stock only the best-selling software, and these are usually a safe bet. Remember though that the games market is dictated by youngsters whose tastes may not be the same as yours – and their reflexes may be a lot better.

Finally, Acornsoft is soon to produce a catalogue of software and products from other companies it recommends. Look out for news in *Acorn User*.

Q Everyone talks about ROMs and firmware, but I bought *Wordwise* and a friend told me it was on an EPROM, and that his *View* was on a proper ROM. What is the difference? **Helen Phillips** Birmingham

A A ROM (read-only memory) is a chip on which information is stored and cannot be easily wiped out. An EPROM is an erasable/programmable ROM, on which the information can be destroyed if the chip is exposed to ultra-violet light. If you remove the label from the EPROM, you will actually be able to see the silicon chip covered by plastic inside its casing. This means an EPROM can be wiped and then re-used, whereas a ROM cannot.

Acornsoft has put View on ROMs because they are cheaper – but only if they are ordered in very large numbers. Smaller companies use EPROMs because they can be produced in small numbers, giving more flexibility and costing less in the short term. Also, EPROMs can be recalled and exchanged more easily because they are valuable – costing about £8 each. ROMs just have to be thrown away.

The best example of this was Acorn's original 0.1 operating system. This was sent out on EPROM as it was a temporary system, whereas the 1.2 version is in ROM as it will be produced in large numbers over several years.

The term 'firmware' just means a piece of hardware on a chip, such as the BBC's ROMs and the Electron's cartridges.



FATMAN ON THE MOVE

Harry Sinclair shows you how to animate your character

LAST month I presented a program that enables you to design multi-coloured mode 2 'sprites'. As promised, this month's article introduces a program which allows you to move your creations around the screen smoothly without disturbing any background, maintaining their original colours at all times. Not only that! If you want you can have cartoon-style animation.

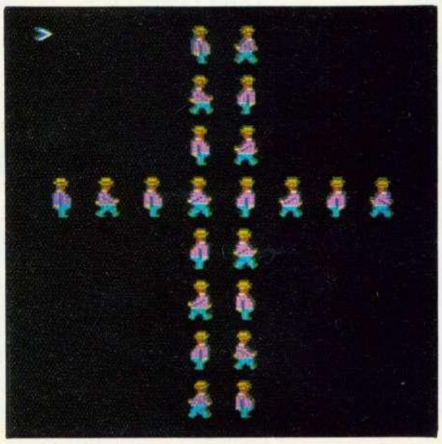
You don't have to understand exactly what is going on, but it helps you to know the general picture, especially for the animation part.

Apart from its obvious job, last month's program performs three main functions:

- It organises your data into easily usable blocks.
- It sets up a table containing the start address of the data for each of your sprites and saves it with the rest of the data.
- It saves information about the width of your sprites so that this month's *Mover* program automatically knows how big to draw them.

The importance of these three things is that the *Mover* program can quickly put your data on the screen just by knowing which character you want to display and where you want to display it. If you aren't particularly interested in the details of how the program works, all you need to know is:

- It should be typed in and subsequently LOADed with PAGE set at &1900.
- You must save it before you run it.



Fatman can be moved to any position on the screen

- When you want to move a set of characters around, *LOAD them first and then run the *Mover* program.

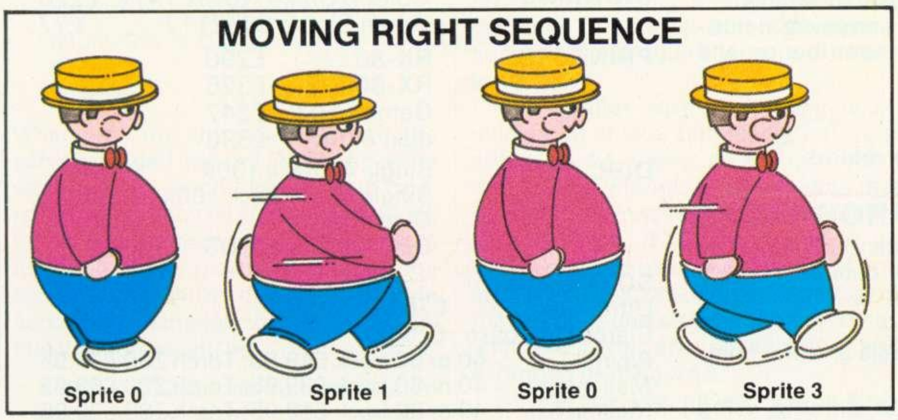
As I explained last month, the designer program allows six sprites to be defined at a time but it regards them as being 8. Sprites 0 and 2 are the same, as are sprites 4 and 6. This means that if you ran through them in sequence you would get sprites 0, 1, 0, 3, 4, 5, 4, 7.

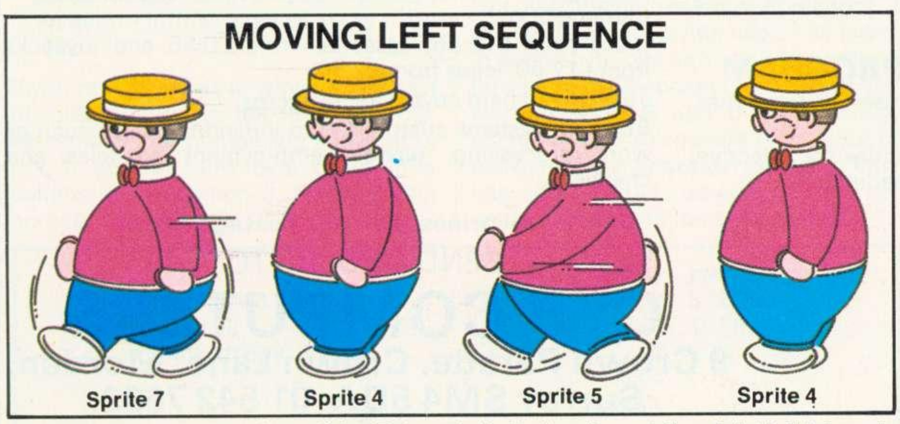
In other words, if you want to produce animation effects – say, of a man walking right to left – sprite 0 should be of a man standing feet-together facing right. Sprite 1 would be man with left leg forward, right leg back, sprite 3, right leg forward, left leg back. That completes the moving right sequence. The moving left sequence is the same but with the man facing the other way. (I'm not sure whether I understand all that. It's a bit like describing Dolly Parton with your hands tied behind your back).

Anyway, when you're designing, you don't have to worry about duplicating sprites 0 and 4 – the program does it for you. If you look at the screen shots accompanying this article you'll see

page 67 ▶

Harry Sinclair's 'Mover' program is listed on yellow pages 100 and 101





The animation sequence for walking Fatman in both directions, left and right. It takes six sprites, two being repeated

how Fatman is organised. He is eight pixels (four bytes) wide.

If you select the animation option, *Mover* runs through the sprite sequence 0-3 when the cursor right key is pressed and 4-7 when the cursor left is pressed. Up cursor and down cursor just move the currently displayed sprite in the appropriate direction. The key detect routine can tell if two keys are pressed at the same time, so you can give your sprites a headache if you're feeling evil.

That's all you need to know if you want to start typing. Incidentally, if you don't want to type it all in at once just stop when you're cheesed off and save what you've done. Then, suitably uncheesed, load the program, list it then type AUTO XXX where XXX is a number 10 higher than the last one. You can then carry on.

Right, now for the tricky bit – full screen addressing.

A mode 2 screen is composed of 32 (0-31) horizontal 'strips', each eight bytes deep and 80 bytes wide. Type in the following short program.

```
 10 *TV255
 20 MODE 2
 30 screenstart = &3000
 40 FOR I% = 0 TO 31
 50 S% = screenstart + I%*640
 60 IF NOT I% MOD 2 C% =
    &03030303 ELSE C% =
    &3F3F3F3F
 70 FOR J% = 0 TO 639 STEP 4
 80 J%!S% = C%
 90 NEXT
100 NEXT
```

When you run this you will see the screen divided into red strips and white strips – 16 of each. Every strip represents 8 deep by 80 wide = 640 (&280) bytes. Screen memory in mode 2 starts at &3000. If you pick a location on the screen – say third down, 20th byte across within the fourth strip, you know that its address will be:

&3000 + (&280 * the number of complete strips above your chosen location – in this case 3) + (8 * 19) + 2

If you're puzzled as to why the last part of this equation is not (8 * 20) + 3, remember that numbering starts at 0, not 1. So the third byte down in a column is in position 2, and the 20th across in position 19.

To complete the example, the final address is shown in figure 1.

If you add an extra line to the above program:

```
110 ?&380A = 0
```

this will make that particular location black.

So calculating screen addresses is not very difficult. The only problem is that if you're using this method to draw a character to the screen and the character is 24 bytes deep and four bytes wide, the calculation has to be done 96 times – pretty time-consuming. Another way of doing it is to calculate the address of each of the leftmost bytes.

Let's take the above address as an example – &380A. The address of the location immediately to the right of that is just eight higher – &3812 – and the one next to that is eight higher again – &381A. Add the following line to your program:

```
120 ?&3812 = &F:?&381A = &30
```

When you run it you will have three bytes in a row in strip 4 – the first black, the second yellow and the third blue.

Calculating the left-hand address and then adding eight to it to get the next one is a bit more efficient, but not much. There are a few variations on this method but they all require a fair amount of calculation, and microprocessors, oddly enough, were not designed to perform arithmetic operations – logical operations are their forté.

Yet another way of doing it is by using a bit of lateral thinking. Say your sprite is 24 bytes deep – it doesn't matter how wide it is. This means that its depth is equal to that of three of the screen strips. If your sprite is to be drawn starting exactly at the top of one strip it will finish exactly at the bottom of the next-but-one strip beneath it. Bytes within a strip are consecutive and arranged as in figure 2.

As you can see, all we have to do is calculate the addresses of A, B and C. If the sprite is four bytes wide – 32 bytes in each strip – we can send our data to three lots of 32 consecutive addresses starting at A, B and C respectively, using the Y or X registers of the 6502 to increment the address relatively. This has the added advantage of not actually changing the base address. In fact it's even easier than that. Since each strip contains 640 bytes, address B = address A + 640 and address C = address B + 640, so we can generate addresses B and C by simple addition.

Well, that's fine for sprites that start exactly at the top of a strip, but what about ones that start within a strip?

Consider our 24-bytes deep sprite. If it starts at the top of a strip it will appear in three strips. If it starts within a strip, parts of it will appear in four strips. We need one extra address – the top of strip 4 – which we get by adding another 640. All we have to do now is ensure that we write only to the bytes we want to.

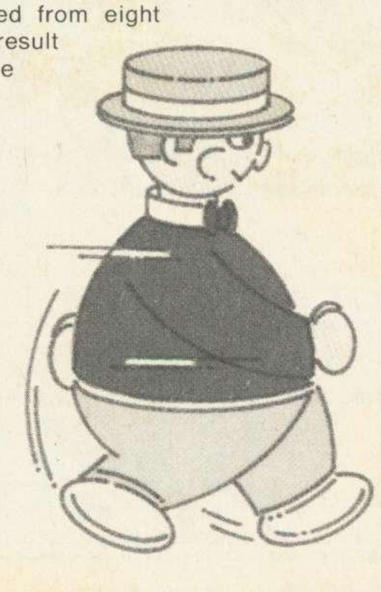
The exact start point of a sprite within a strip is easy to calculate. Remember that the vertical axis (Y) has 256 possible values – 0 to 255. Y MOD 8 or Y AND 7 give the remainder of Y divided by eight – the start position. If this is subtracted from eight the result is the

			&3000	start of screen
Y co-ordinate DIV 8 * 640	=	+	&780	3 * &280
X co-ordinate * 8	=	+	&88	19 * 8
Y co-ordinate MOD 8	=	+	2	
	=		&380A	

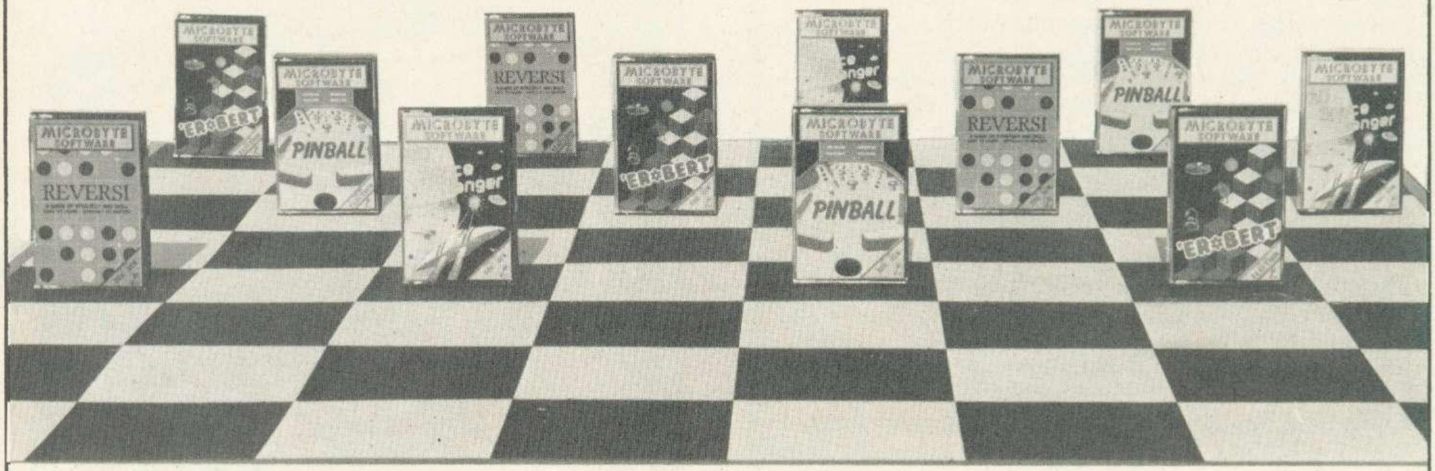
Figure 1.

STRIP 1	A A+1 A+2 A+3 A+4 A+5 A+6 A+7	A+8 A+9 A+10 A+11 A+12 A+13 A+14 A+15	A+16 A+17 A+18 A+19 A+20 A+21 A+22 A+23	
STRIP 2	B B+1 B+2 B+3 B+4 B+5 B+6 B+7	B+8 B+9 B+10 B+11 B+12 B+13 B+14 B+15	B+16 B+17 B+18 B+19 B+20 B+21 B+22 B+23	*etc*
STRIP 3	C C+1 C+2 C+3 C+4 C+5 C+6 C+7	C+8 C+9 C+10 C+11 C+12 C+13 C+14 C+15	C+16 C+17 C+18 C+19 C+20 C+21 C+22 C+23	

Figure 2. How bytes are arranged within a strip



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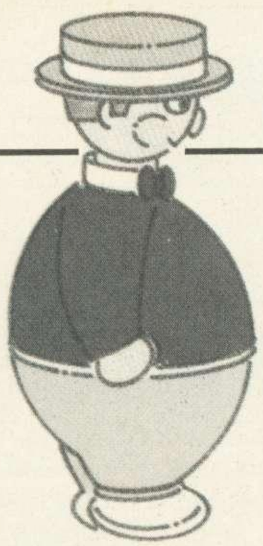
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18 Hilgrove Road, Newquay, Cornwall TR7 2QZ



number of bytes in each column in strip 1 that should be written to, and the number of bytes in each column in strip 4 that should *not* be written to. In the program, this value is put into the X register each time a new column is to be drawn and is decremented each time a set of bytes (one to each strip) is sent. While X is positive, bytes will be written to strip 1 and not to strip 4. When X is negative the reverse is true. The value is also used to control the (negative) offset into the sprite data tables.

The only other thing you have to do is to ensure that other characters on the screen are not rubbed out as your sprite is moved about. A common way of doing this is to use what is called EOR (Exclusive OR) plotting. EOR is one of the logical operators and is very simple. If you EOR K with J to give you N, when you then EOR N with K you will get J, or if you EOR N with J you will get K. EOR works by taking two binary numbers and comparing pairs of bits. Each bit in no. 1 is compared with the corresponding bit no. 2.

If either (but not both) of the bits is set – ie = 1 – the corresponding bit in the result is set. If both or neither of the pair is set, the result bit is zero – eg:

6 EOR 3 = 5
6 = 00000110
3 = 00000011
Result = 00000101 = 5

6 EOR 5 = 3
6 = 00000110
5 = 00000101
Result = 00000011 = 3

3 EOR 5 = 6
3 = 00000011
5 = 00000101
Result = 00000110 = 6

So if you take the value (V) you want to write to a screen byte and EOR it with the value already there (S), you will get a new value (N) – and unfortunately a new colour unless the value already there is 0. When you want to move your sprite to a new position and replace the background you just repeat the operation. EOR V with the screen byte (now N) and you get the original screen byte S. On screens that are mainly black this is a very effective method.

The method I have used is different. Before any screen byte has a new value written to it, its original value is stored. The original values are written back before the sprite is drawn in a new position. This way your sprite's colourings are maintained at all times and there is absolutely no disturbance of any background.

Two other parts of the program may interest you – speed control and the keypress-detect routine.

Speed control is achieved by the use of an interrupt routine. The vertical sync. pulse event is enabled by the equivalent of *FX 14,4. This generates an interrupt every fiftieth of a second as the screen is about to be refreshed, and control is passed to a user routine whose address is contained in locations &220 and &221 – the event vector. All this routine does is decrement location &77. When you run the program you are asked what delay factor you want to use. When the sprite is about to be written to the screen the delay routine is executed the number of times you have specified. The routine loads the contents of &77 into the accumulator and then continues to compare the accumulator with the current contents of location &77 until they are different – ie the vertical sync. pulse event has occurred.

The key detect routine, which is very fast – it should only take 12 machine cycles out of 2 million per second to discover that no key has been pressed – examines locations &EC and &ED in the operating system workspace. If one key is being pressed, location &EC contains its internal key number + 128 and &ED contains 0. If two keys are being pressed location &EC will now contain the internal number of the *second* key pressed + 128 and &ED will contain the internal number + 128 of the *first* key pressed. If no keys are being pressed both locations contain zero. You may like to modify the routine for your own purposes.

Internal numbers are with very few exceptions easily generated from the negative INKEY numbers. Take the negative number, reverse the sign, and add 1. For instance, if you wanted to test for 'A' being pressed, in Basic you would use INKEY (−66). The internal number would be 65, coincidentally the ASCII code for 'A'. To use my routine you would check for 193 (65 + 128). Negative INKEY numbers are given on page 275 of the *User Guide*. The *Advanced User Guide* also gives the internal key numbers.

Well, I hope this has given you some ideas and that you get a bit of fun out of the two graphics programs. Next month I will give you some modifications for the *Design* program that allow you to edit previously designed sprites and produce mirror images so you only have to design your animation characters facing one way. I will also give you a procedure that will take the data for a sprite, shift it all over by one pixel and store the new image. You will then be able to move your sprites very smoothly – one pixel at a time – by alternating the images.

MOVER PROGRAM DESCRIPTION

20 If you want your sprite data to autoload make this line *LOAD followed by whatever you called your sprites.
80 to 120 Check to see if animation is required and set the flag (&74) accordingly. The machine code checks this location and if it is set it ensures that sprites are displayed in the sequence 0, 1, 2, 3 when moving right and 4, 5, 6, 7 moving left.
130 If animation not required and only one sprite is to be displayed, which one?
160 Gets the delay factor – see text.
170 to 210 Instructions.
240 Sets screen background.
250 to 270 Set control variables.
280 Calls routine to point EVENTvector to program interrupt routine.
290 Displays sprite for the first time.
300 Enters the main program.
310 Cleans up when Basic re-entered.
370 to 490 Leftpressed. Decrement X axis value unless it is already zero. Check if animation required – if so it sets left flag and gets next character in the sprite sequence from 'animation'. Pass control to *Mover*, which operates the delay mechanism and calls the display routine.
500 to 610 Rightpressed. Increment X axis value unless it is already 80 − width of sprite (contents of &7A). Other actions as above.
620 to 760 Downpressed/up-pressed. Control Y axis value in similar manner except animation not used.
Where appropriate the above routines are called by the key detect routine, 'keycheck'. page 70 ▶



MOVER PROGRAM DESCRIPTION (cont)

770 to 910 Animation. Test the left/right flag (&75). If right has been pressed the X axis value is ANDed with 3 to give a sprite number in the range 0-3. If left has been pressed, 4 is added to make the range 4-7. Since the X axis is increased or decreased only by 1 at a time this routine is always able to pass the next sprite number in sequence to the display routines.
920 to 1040 Mover. If no delay is required &76 will be negative so the delay routine is skipped. Delay (see accompanying text).
1050 to 1090 Nv. This is the vertical sync. pulse event routine which decrements &77 each time the event occurs.
1110 to 1490 Cv. Change contents of the event vector at &220/&221 to point to above routine. Store old contents so they can be restored when Escape is pressed to give orderly return to Basic – not strictly necessary in this case but good practice. Also enable the vertical sync. pulse event. Set variable offset into data tables. Calculate maximum allowable X axis value given the width of the sprite, and store this in &7A. This enables use of variable-width sprites from designer program. The storage area for screen background is set up by inserting addresses based on the size of the sprite into the address fields in the 'replace' routine (see below).
1500 to 1740 Start. Put addresses of control routines into table so they can be accessed quickly by the keypress detect routine.
1750 to 1890 Keycheck. Executive section of program from which all other control routines are accessed. Arranged as an infinite loop which can only be exited by pressing Escape. See text.
1900 to 2180 Keyvalid. If a 'valid' key has been pressed (ie any of the cursor control keys or Escape) an appropriate value is returned in the accumulator. In the case of Escape being pressed, the return address of the routine calling keyvalid is pulled off the stack and a jump is made to the escape routine. This ends with RTS so with no other address to return to control is passed back to Basic. See text for explanation of values tested.
2190 to 2270 Getaddress. The value returned in the accumulator by 'keyvalid', if non-zero, is multiplied by 2 and transferred to the Y register, which is then used to get the address of the appropriate control routine. This address is inserted in place of the dummy operand in 'gotomover', which is then called by the main control section.
2310 to 2410 Escape. Replaces original contents of the event vector, flushes the keyboard buffer and returns to Basic.
2420 to 2450 Tbl. Storage area for addresses of the up/down/right/left control routines. Those with Basic 2 can replace NOP with EQUD etc to define zero bytes, but it isn't necessary. Note that 10 bytes are needed since the first two bytes cannot be accessed by 'getaddress'.
2460 to 2470 Olv. Two-byte storage area for original contents of event vector.
2480 Display. Loads Y register with number of bytes to be written to each strip, contained in &78.
2510 to 2640 Replace. Return the original contents of screen memory to location where last sprite has been drawn – ie delete it before drawing sprite in new position. The low bytes of the storage addresses are dummies and vary according to the width of the sprite.
2650 First. When a sprite is first drawn it is unnecessary to call 'replace' since there is nothing to replace, so the drawing routine is entered here. The start addresses of the strips are calculated and the calculation is simplified a little by accessing the *640 table in the OS ROM starting at &3C75. Start addresses of the sprite data are obtained from the table at &12F0 (lines 3270 and 3440), are modified by the offset contained in &73 and inserted into their zero page locations (&88 onwards).
3520 Loads Y register with the number of bytes to be written to each strip.
3530 to 3540 X register set up to control writing.
3550 Start of the main drawing routine.
3850 to 4170 Sh. This is what actually puts your sprites on the screen and also what saves the background. The low byte of all addresses shown as &C00 is a dummy which is changed by the routine 'cv' above, to accommodate sprites of different sizes. The sections that write to the separate strips are 'b2', 'b3' etc.

ZERO PAGE LOCATIONS USED

&70 =	Number of sprite to be displayed.
&71 =	X axis value – 0 to 79.
&72 =	Y axis value – 0 to 255.
&73 =	Y MOD 8 at first then 8 – (Y MOD 8) + 1 to control display routine.
&74 =	Animation flag. 0 = no animation 1 = animation.
&75 =	Left/right flag if animation selected 1 = leftpressed 0 = rightpressed.
&76 =	Number of vertical sync. pulse interrupts to occur before sprite is drawn to the screen = delay factor – 1, so negative (&FF) if no delay required.
&77 =	Used to sense if vertical sync. pulse has occurred. Is decremented at each such interrupt.
&78 =	Width of sprite in bytes * 8 = block size.
&79 =	(Width of sprite * 8) – 8 = additional offset into sprite data tables.
&7A =	Maximum X axis value allowable (80 – width of sprite in bytes).
&80/&81	Start screen address for strip 1.
&82/&83	,, ,, ,, ,, ,, 2.
&84/&85	,, ,, ,, ,, ,, 3.
&86/&87	,, ,, ,, ,, ,, 4.
&88/&89	Start address of sprite data for strip 1.
&8A/&8B	,, ,, ,, ,, ,, ,, ,, 2.
&8C/&8D	,, ,, ,, ,, ,, ,, ,, 3.
&8E/&8F	,, ,, ,, ,, ,, ,, ,, 4.

*&12EF is part of the sprite data tables and contains the number of bytes in each block = 8 * width (in bytes – not pixels).*


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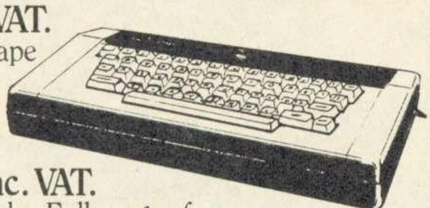
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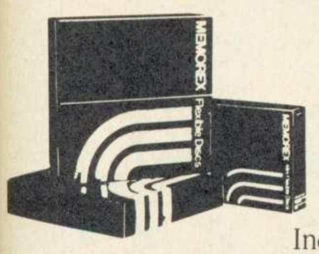
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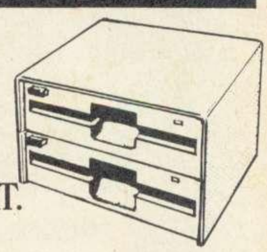
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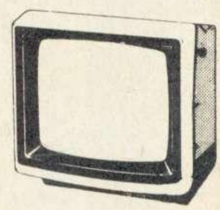
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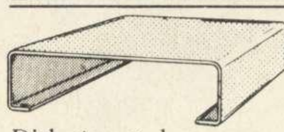
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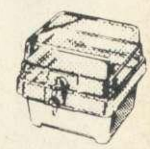
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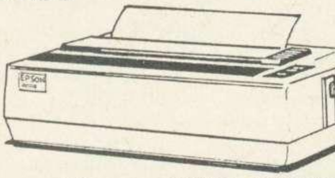
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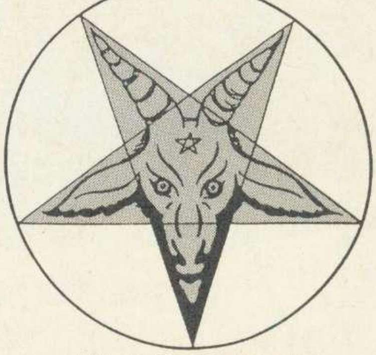
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ANNIVERSARY ANSWERS

Simon Dally separates the winners from the wallies among the entrants to our 20-question birthday quiz featured, complete with tie-breaker, in the July issue

OUR July competition celebrating the second birthday of *Acorn User* was the easiest ever (thanks to the generous nature of our editor). Many of the 250-odd entrants pointed this out. But, alas, only about a third of all entries proved to be correct!

The commonest mistake made was to think that the first computer to be sold for less than £100 was the ZX81. In fact, it was its predecessor, the ZX80, though not a few of the entries thought it was the Atom. Also, an enormous number thought the Basic statement DIM A$(20,2) produces an array of 40 elements: in fact it creates 63 – remember the first element will be A$(0,0)!

A few entries even managed to get the date of the original issue of *Acorn User* wrong – despite the fact that all over the magazine were plastered the words 'second anniversary issue'! Ah well, if there's one thing queerer than folk, it's *Acorn User* competition entrants...

The correct answers were:

1)b; 2)a; 3)c; 4)b; 5)b; 6)b; 7)b; 8)b; 9)c; 10)a; 11)b; 12)a; 13)b; 14)b; 15)a; 16)a; 17)c; 18)b; 19)a.

Judging tiebreakers ('I like Acorn User because ...') is never easy (sob ... now I know how washing-powder manufacturers feel) but in the end, we felt the best two were from M Fulker of Hungerford, Berks, who wrote: '... *it gives a profusion of solutions to Basic confusions and programming illusions* ...', and Charles Williams of Coventry, whose slogan was: '... *because it is Authoritative, Clarifying, Outstanding, Relevant, Necessary, Useful, Sensible, Educational, Recommendable, and very good value for money...*'.

A consolation prize goes to Nick Evans of Grimsby, who appended his corny pun with the message, 'Well, what do you expect for a T-shirt?'. The duffer's prize goes to C M Hempsell of Hitchin, Herts, whose slogan was 'I like *Acorn User* because the competitions are so easy' – but he got no fewer than three of his 19 answers wrong ...

The 20 winners of the first prizes (five packs of software) and the 10 winners of the second prizes (*Acorn User* sweatshirts) have all been notified.

HARD DIAMOND

This month's gem: a palindromic puzzle

THIS month's problem is taken from the shortly-to-be-published *Century/Acorn User Book of Computer Puzzles*, which is the result of the competition we set you earlier this year, inviting you to send in your own puzzles. This one was submitted by J Oldroyd of Batley.

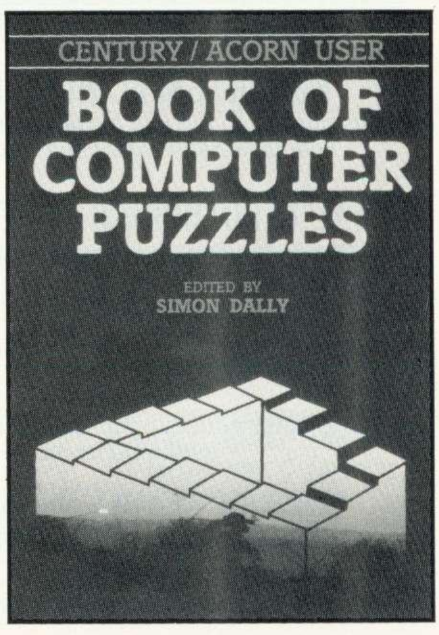
Look at the diamond of letters. The object is to find as many ways that the palindromic sentence RISE TO VOTE SIR can be read (a palindrome, just in case you don't know, is something which reads the same both backwards and forwards).

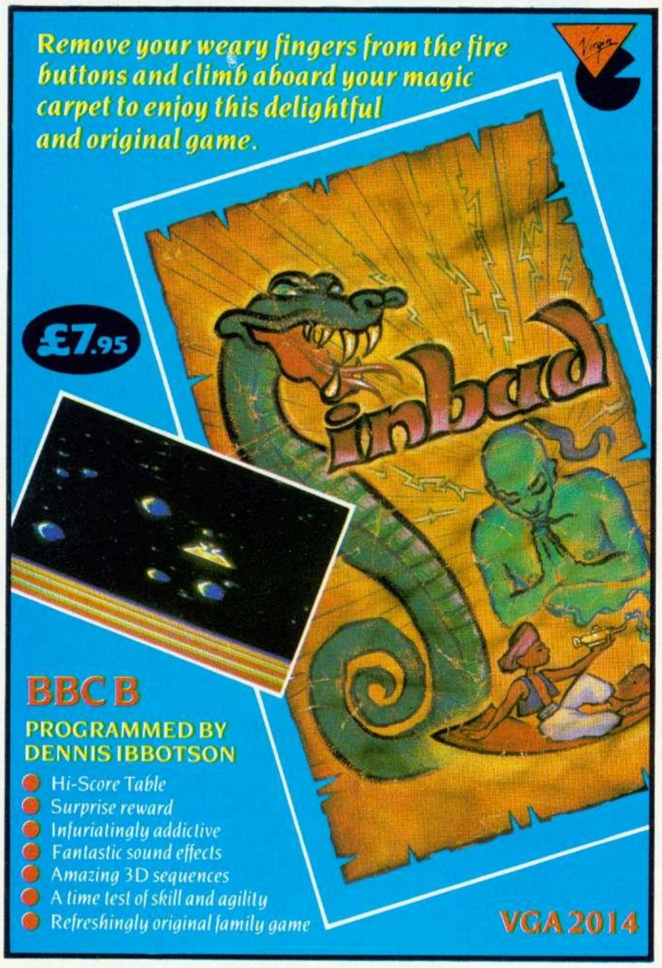
You may move in any direction to an adjacent letter and you can use the same letter twice or more.

Incidentally, J Oldroyd's program goes on to solve all palindromic puzzles of this nature.

Answers on a postcard, please, to October Competition, Acorn User, Redwood Publishing, 68 Long Acre, London WC2E 9JH, to arrive not later than Friday November 2, 1984. Prizes of two Acornsoft packages (worth £20) will go to the first five correct solutions taken from the bag. Century is offering six copies of the book to the runners-up.

```
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          R I R
        R I S I R
      R I S E S I R
    R I S E T E S I R
  R I S E T O T E S I R
R I S E T O V O T E S I R
  R I S E T O T E S I R
    R I S E T E S I R
      R I S E S I R
        R I S I R
          R I R
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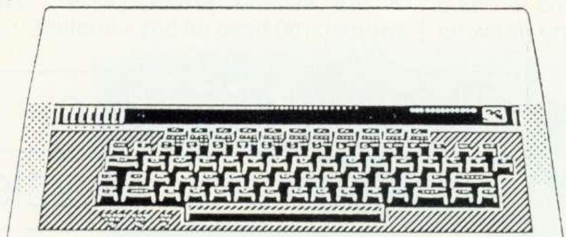
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TAKE COMMAND OF THE 8271 CHIP

By programming the floppy disc controller you can out-perform the DFS. Richard Harris has the details

THE 8271 floppy disc controller (FDC) chip is a complex piece of electronics, allowing relatively easy control of up to four disc drives. This article will try to explain how to program the 8271: it will not cover the circuitry of the disc interface since there is no benefit from altering this. The circuit itself can be found in the *User Guide* and *Advanced User Guide*.

Why bother with programming the 8271, since the disc filing system (DFS) does it all for you? There are several reasons. First, simply to know more about how your computer works, especially as little information has been made available on the disc interface. Once mastered, it is possible to write your own data handling routines which for some applications are more efficient and quicker than those in the DFS. You will also discover some of the tricks to protect your discs and, possibly, to make backup copies of other discs. It is also possible to modify protected programs: at the end I'll show you how a simple change in *Aviator* can be made to alter the keys used.

Figure 1 shows the overall structure of the 8271, and details of the control logic and registers are listed in figure 2.

The value obtained from the Result register gives the following information about the command just processed:

Bit 7,6	Not used
Bit 5	Set if deleted data found (see below)
Bit 4,3	Completion types: 0,0 = good completion 0,1 = system error, may be recoverable if retried 1,0 = 'fatal error' 1,1 = 'fatal error'
Bit 2,1	Completion code (see below)
Bit 0	Not used

Type	*Code*	*Meaning*
0,0	0,0	good completion
0,0	0,1	scan result – see later
0,0	1,0	scan result
0,1	0,0	clock error
0,1	0,1	late DMA – see later
0,1	1,0	ID CRC error – see later
0,1	1,1	data CRC error – see later
1,0	0,0	drive not ready
1,0	0,1	write protected disc
1,0	1,0	track zero not found
1,0	1,1	write fault
1,1	0,0	track/sector not found

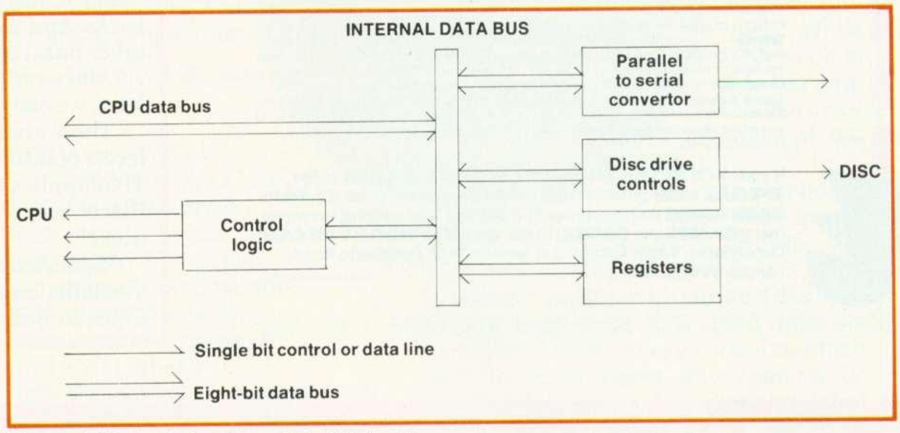


Figure 1. Overall structure of the 8271 chip

Register	Address in BBC	Type	Comments
COMMAND	&FE80	Write	The various commands are entered here
PARAMETER	&FE81	Write	Commands take up to five parameters, entered here
RESULT	&FE81	Read	
STATUS	&FE80	Read	
RESET	&FE82	Write	

All data transfers occur at address &FE84, both reading from the disc and writing to it

Figure 2. Details of the 8271's control logic and registers

Incidentally, these are the values given in the Acorn DFS errors 'Disc fault at ...' and 'Drive fault at ...'.

The Status register gives information about the 8271's internal working:

Bit 7	Command busy; set to 1 if processing command.
Bit 6	Command full; set to 1 when command written to 8271 and cleared when begins processing.
Bit 5	Parameter buffer full; if set to 1 further parameters should not be written.
Bit 4	Result ready; after a command is completed bit 7 goes low and this bit is set to 1. It is cleared by reading the result register.
Bit 3	Interrupt request; reflects state of interrupt line. Cleared by reading result register.
Bit 2	Non-DMA data request; if DMA is not being used, set to 1 if interrupt is for data transfer rather than end of command

Bit1,0 Not used

A reset is initiated by writing 1 and then 0 to the reset register. All drive control signals go low, commands in progress are aborted, status register flags are cleared, and an idle state occurs until the next command is entered. This mimics a hard reset via the reset pin.

The operation of the 8271 falls into three phases.

1 *Command phase.*
This starts with the issue of a command after checking the status register to ensure the 8271 is not busy. If parameters are needed these are then issued, checking before each one that the parameter buffer is empty. Failure to check may result in loss of a parameter.

2 *Execution phase.*
During this phase the computer can ignore the 8271 until the command is completed. This will be signalled by an interrupt. For this to occur a special chip is used to handle data transfer: a direct memory access device (DMA). The DMA can address, load and write to memory during part of the clock cycle not used by the central processor; the only information the DMA needs is the start address in memory for the data transfer. However a DMA is not used in the BBC micro, so any data transfers needed (each byte) are signalled by an interrupt and processed by the 6502. Because of the importance of this data transfer and the high speed at which it occurs, the high-priority non-maskable interrupt (NMI) is used, overriding any interrupts from internal timers, analogue to digital convertors, keyboard and so on which use the interrupt request (IRQ). In the BBC micro the routine to handle NMI interrupts is based at &D00 and only very urgent needs are allowed to use it. These are the disc and Econet interfaces so far.

3 *Result phase.*
This notifies the successful completion of the command, or an error occurring during the operation.

Fortunately, the Acorn DFS provides a routine to carry out most of the complex control of the 8271: OSWORD routine with A=&7F which performs 'read/write a sector' as detailed in the DFS manual. In fact it will do much more than just read or write a sector.

As with all OSWORD routines, the 6502 accumulator (or A% if called from Basic) indicates which routine, while the X and Y registers (or X% and Y%) hold the address of the parameter block (X=low byte, Y=high byte). The call address is &FFF1.

The parameter block is as follows:

Offset from base address	
0	Drive number
1–4	Address in memory where data is to be sent to or from disc
5	Number of parameters needed by the 8271 command
6	8271 command
7	1st parameter
8	2nd parameter
9	etc

This routine handles all three phases of the 8271 operation. On completion the byte above the last parameter will contain the value in the result register and should contain zero if successful.

In Basic a simple routine would be:

```
10   DIM block 20, data 256
.
.
1000 A%=&7F:X%=block MOD
     256:Y%=block DIV 256
1010 block?0=drive
1020 block!1=data
1030 block?5=noofpar
1040 block?6=command
1050 block?7=param1
1060 block?8=param 2
1070 CALL &FFF1
1080 IF block?(7+noofpar) <>0
     THEN PRINT "error!"
```

Before detailing the various 8271 commands, the layout of data storage (or 'format') on a disc must be understood.

Data is stored in concentric 'tracks' around the disc, there being 35, 40 or 80 tracks depending on which type of 5¼ in disc drive is in use. The 8271 will also support 8 in drives. Each track is subdivided into a number of 'sectors', which consist of an identification (ID) field and a data field. The number of bytes of data per sector depends on the number of sectors per track. The 'first' sector on a track is identified by the 'index hole', the small hole in the disc which allows a photocell to detect a pulse of light once per revolution of the disc. The first sector is the one that immediately follows the light pulse.

The general layout on each track is shown in figure 3 and the ID fields in figure 4.

The 'gaps' are fixed or variable numbers of bytes that prevent sectors overwriting each other if the disc revolution speed should vary slightly.

Both the ID field and the data field have additional bytes called the Cyclic Redundancy Check (CRC) bytes. The value of these depends on the value of the rest of the bytes in the field and allows a check on the accuracy of subsequent reading of the field. While reading in the bytes, the CRC value is recalculated and compared to the original CRC; if these are not equal an error must have occurred and one of the error codes is generated.

The relationship between number of sectors per track, sector size, sector length (number of bytes of data) and gap size is set out in figure 5.

Gaps 1 and 3 can be varied if desired; 2 and 4 are fixed. 1, 2 and 3 have six additional bytes, always present, which act to synchronise any reading or writing operations. This gives a total of 3125 bytes per track, with a maximum of 2560 bytes of actual data. The format command (see below) also expects details of Gap 5; this is used only with 8 in discs and should be set to zero with 5¼ in discs.

It might be useful to describe some tricks that can be done with the format. With a 40-track disc one can command the drive head to be stepped to any of these, ie 0 to 39. However, one can number the track in the ID field anything from 0 to 255. One could step out to track 5 and then fool the 8271 into thinking that the current track is 78, for

Index

Gap 4	Gap 1	ID	Gap 2	Data, sector 0	Gap 3	ID	Gap 2	Data, sector 1	Gap 3

Figure 3. Layout of a disc track

Track	Drive	Sector	Sector length

Figure 4. The ID fields

No. of sectors	Size/length		Gap 1	Gap 2	Gap 3	Gap 4
18	0	128	16	11	11	24
10	1	256	16	11	21	30
5	2	512	16	11	74	88
2	3	1024	16	11	255	740
1	4	2048	16	11	0	1028

Figure 5. Relationship between number of sectors per track, sector size and length and gap size

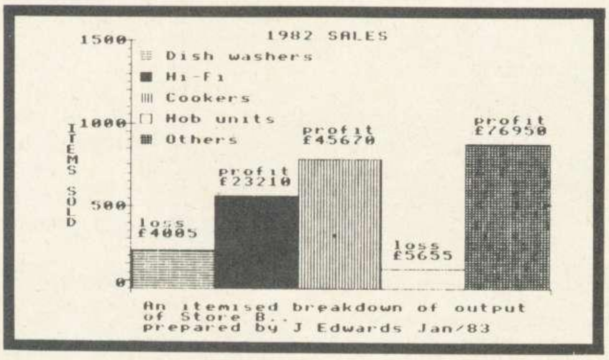
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Screensave facility	YES	YES
Screendump facility	YES	YES
Fixed description per graph (char's)	up to 200	100
Full plot and axis editing	YES	YES
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Single file selection	YES	NO
Operating Manual (pages)	52	52

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Sold	Av Price	Income
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300	438	1314
	Gross Profit	564
	Income	257
	Expenses	101
	Net Profit	**720**
		% Gain = 36

SHARE ANALYSER FACILITIES	DISK	CASSETTE
No of prices stored	20,000	Appx 1700
Max no' of Holdings	20	20
Transactions per holding	16	16
Range adjuster	YES	NO
File Manager	YES	NO
Printer Manager	YES	NO
REPORTS PRODUCED:-		
Portfolio Valuation	YES	YES
Portfolio Profit Analysis	YES	YES
Share Profit Analysis	YES	YES
Share Movement Analysis	YES	YES
Transaction Record Report	YES	NO
File Status Report	YES	NO
GRAPHICS FACILITIES:-		
Magnification option	YES	YES
Grid	YES	YES
Autoscale	YES	YES
Screenwrite	YES	YES
Screendump	YES	YES
SELECTABLE GRAPHICAL INDICATORS:-		
Lagged Moving Average	YES	YES
Centred Moving Average	YES	YES
Rise and fall indicator	YES	YES
Weekly/Daily Low indicator	YES	YES
Superimpose Facility	YES	YES

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instance, whereas the usual DFS commands would simply report a disc error with this format. Thus one can talk about 'physical track numbers' and 'logical track numbers' (ie, that in the ID field). Logical track numbers do not have to follow any particular sequence; they can even be in reverse order (normal is 0 outermost).

The same applies to sectors; with a 10-sector format, the physical numbers would be 0 to 9. They can be given any logical number between 0 and 255, in any order, not necessarily sequential. There are, however, advantages to using sequential addresses in ascending order. The 8271 can be ordered to load into memory more than one sector at a time – for example start at sector 3 and load in four sectors. This will occur only if sectors 3, 4, 5, 6 are on the current track and it will be much quicker if they are in ascending order.

Interestingly, most efficient operation of the normal DFS occurs if physical sector 0 does not have logical number 0 on each track.

Thus if track 0 has sectors

0, 1, 2, 3, 4, 5, 6, 7, 8, 9

track 1 should be

7, 8, 9, 0, 1, 2, 3, 4, 5, 6

and track 2 should be

4, 5, 6, 7, 8, 9, 0, 1, 2, 3

Consider loading a program which covers more than one track on a disc without these sector offsets. The sectors on the first track will be loaded to sector 9, then the head will be stepped out to the next track – to just miss sector 0, as stepping is not instantaneous. A complete revolution of the disc then has to occur before sector 0 reappears. The offset described above ensures that the first sector encountered after stepping is 0. The actual offset needed will depend on the disc drive characteristics.

8271 commands

The general format of the command byte is for bits 6 and 7 to select which drive is in use, and bits 0-5 to specify the command. OSWORD &7F sorts out which drive (specified as the first parameter); so bits 6,7 of the command appear irrelevant. The DFS manual suggests they are set to 1,0, ie &40. This value should be added to the command value given below (eg, 'read data' &13 becomes &53 for the OSWORD parameter block).

SPECIFY
Command byte = &35
Uses four parameters
This command is used to initialise the 8271 with the physical properties of the drive in use. It can also be used to tell the 8271 of any 'bad tracks' (ie, ones that will not format correctly). Once notified of these, the 8271 will automatically step over them as though they did not exist. This saves a disc being unusable simply because one or two tracks are faulty.

This facility is not used in the Acorn DFS, though modern discs are of very high quality and 'bad tracks' are a rarity.

The parameters are listed in figure 6.

Before expanding on the initialise parameters, a brief note about disc drive mechanisms. The disc itself is rotated at a constant speed by a motor, each rotation being detected by the index pulse. Data is read off the disc by the 'head'. This has two controls: a stepper motor that moves the head across the disc in a series of steps, these being the tracks; second, the head can be 'loaded' – that is, brought into contact with the disc, allowing reading/writing of data. There is in addition a micro-switch to detect when the head is stepped outwards as far as it can go – that is, when it is at track zero.

The speed of stepping between tracks varies with different makes of drive; parameter 2 defines this as 0 to 255ms (milliseconds) in 1ms steps. Likewise the time it takes for the head to settle after loading varies and can be set by parameter 3 (0 to 510ms in 2ms steps). Parameter 4 allows two features to be set. Bits 4 to 7 set the index count; this is the number of disc revolutions that occur after the last command before the 8271 unloads the head (0 to 14; 15 keeps head loaded). Bits 0 to 3 specify head loading time (0 to 120ms in 8 ms steps).

The Acorn DFS can set up parameters for several makes of drive using the links on the keyboard or *FX255 – see DFS manual and *Advanced User Guide* for further details. Unless you have an unusual make of drive, little will be gained by varying these values.

READ DRIVE STATUS
Command byte = &2C
No parameters
Issuing this command puts the drive status into the results register which then can be read:

Bit 7	Not used
Bit 6	Drive 1 ready
Bit 5	Write fault
Bit 4	Index pulse detection
Bit 3	Disc write protected
Bit 2	Drive 0 ready
Bit 1	Track 0 detected
Bit 0	Count pin (used by 8271 for stepping)

'Drive not ready' is cleared by this command and should be issued during any initialisation.

READ/WRITE SPECIAL REGISTERS
Command bytes = &3D (read), &3A (write)
Uses one parameter
The parameter determines which register is involved:

&12	Drive 0 current track
&1A	Drive 1 current track
&17	Mode register
&23	Disc control output port
&22	Disc control input port
&10	Drive 0 Bad track 1
&11	Bad track 2
&18	Drive 1 Bad track 1
&19	Bad track 2

There are also three registers involved in scanning for data – see below.

The current track registers are the means to having different physical and logical track numbers.

The mode register has the following features: bits 6, 7 must be 1, bits 2-5 must be 0. If bit 1 is set, then the two heads on a double-sided disc move together (ie, always have some physical track number). If bit 0 is clear this means a DMA is in use, if 1 the CPU is used for data transfer.

Drive control input port is the same as reading the drive status, but does not clear 'drive not ready'.

Drive control output port gives the status of various lines between 8271 and drive:

Bits 6, 7	Drive select lines
Bit 5	Not used

Parameters	Initialise	Bad tracks	
		Drive 0	Drive 1
1	&0D	&10	&18
2	Step rate	Bad track no. 1 (physical address)	
3	Head settling time	Bad track no. 2	
4	Index count/ load time	Current track	
Declaring all bad tracks as &FF implies no bad tracks			

Figure 6. The four parameters of the Specify command, useful in informing the 8271 of any 'bad tracks'

Bit 4	Writing to tracks near centre of disc
Bit 3	load head
Bit 2	step direction
Bit 1	step
Bit 0	write enable

SEEK
Command byte = &29
Uses one parameter
The parameter is the *physical* track address required. The head is then stepped to the appropriate point using the current track register as the starting point. Bad tracks will be skipped. The track number is not confirmed by reading the ID field.

A 'seek track zero' is different; here the head is stepped outwards until the track zero signal from the drive microswitch is detected. If this fails after 255 steps an error occurs. A seek track zero should be performed whenever the current physical position is unknown, eg at power-up.

FORMAT
Command byte = &2C
Uses five parameters
This command formats one track at a time. The parameters are:

1	Track address (physical)
2	Gap 3
3	Bits 5 to 7 = sector size (0 to 4) Bits 0 to 4 = number of sectors
4	Gap 5
5	Gap 1

It also requires data for the ID field of each sector, ie four bytes times number of sectors. Each block of four follows the pattern previously described: track number, drive number, sector number, sector size. Thus using the OSWORD routine a block of 40 bytes (for 10 sectors/track) would be pointed to by parameters 1 to 4 of the OSWORD control block.

The track number is the logical number and need not be the same as the physical number. The drive number can be anything from 0 to 255. Sector number can again be any value (see above) but sector size should be the correct value. The first set of values in the data block will be the ID of the first physical sector and so on.

Each byte of the data in the sectors is set to a value of &E5 during formatting. Formatted tracks can be checked with the 'Verify' command (see below).

READ ID FIELDS
Command byte = &1B
Uses three parameters
This command transfers a specified number of ID fields into memory from a track, starting with the one immediately after the index pulse (ie, physical sector 0). The parameters are:

1	Track number (physical)
2	Must be set to zero
3	Number of ID fields to be read

Note that a seek to the specified track occurs, though this is not confirmed by checking with the ID field. Thus if the logical track number is different an error does not occur when reading the ID fields.

Data processing commands

All the following commands seek the specified track and confirm it is the correct one by checking the ID field. If it is not correct the 8271 will try the next two tracks before causing an error ('Track not found').

128 BYTE SINGLE SECTOR
Two parameters

&12	Read data
&16	Read data and deleted data
&0A	Write data
&0E	Write deleted data
&1E	Verify data and deleted data

The parameters are:

1	Track number (logical)
2	Sector number (logical)

If the logical number is not the physical number, the command must be preceded by a 'seek track' command, and then change the current track register to the logical number with the special registers command.

'Verify' data reads the data and checks the CRC values, but does not transfer the data to memory.

'Deleted data' refers to sectors that have a special code and are ignored by the usual read commands, ie it is effectively wiped off the disc. However, the data is still present and can be read or restored if desired later on. It is another way of protecting discs; the usual DFS commands will see only a blank disc!

VARIABLE LENGTH/MULTI-SECTOR
Uses three parameters

&13	Read data
&17	Read data and deleted data
&0B	Write data
&0F	Write deleted data
&1F	Verify data and deleted data
&00	Scan data
&04	Scan data and deleted data

The parameters are:

1	Track number (logical)
2	Sector number (logical; first if more than one)
3	Bits 5 to 7 = sector size Bits 0 to 4 = number of sectors to be processed

See notes on previous command, and earlier notes on formatting regarding multi-sector processing. Processing multiple sectors is much quicker than doing them one at a time. Commands not processing deleted data will skip them and process the required number of normal sectors.

If an error occurs during multi-sector processing the sector at fault can be found by reading one of the 'scan special registers', number &06.

The scan command enables the 8271 to search for a byte pattern on a disc, but is of real value only when used with a DMA.

I hope this article has been some help to those wishing to know more about the disc system. I recommend reading it twice (if you can face it!), as some bits are more easily understood in conjunction with information presented later in the article.

Finally, a disc copying program (listing 1) that will make back-up copies of most discs if not all. Some copies will have to be made onto fresh, unformatted discs. This program is not written in a sophisticated way but in a manner that I hope is easy to follow in conjunction with the article. Many improvements are possible, for example to transfer all the sectors on a track at once.

With some minor changes it can also be used to change protected discs. Omit the 'format' procedure, and read and write to the same disc. In between reading and writing, CALL a machine code monitor and the data can then be examined, disassembled and changed as desired before being written back to the disc. The position of the data in memory can be found by having 'PRINT data' in the first few lines.

One change I've found useful is to alter the keys in *Aviator*. As set up it is impossible to use the joystick and the rudder keys (A and +) together effectively. In logical track number 72 (physical track 8), logical sector number 125 (physical sector 3) will be found a block of data holding the INKEY values (negative numbers) of the keys and used when flying. This includes &FF, &BE, &DD, &DA &C8, &BC, &CA and &A8 etc. If the &BE and &A8 are changed to &9E and &BD then keys Z and X will control the rudder – now one hand can operate these and fire with shift, while the other uses the joystick.

Richard Harris' disc copier is listed on yellow page 102



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COMMANDS

*CHECK	Verify a program or data in memory with disc/cassette.
*CLEAR	Clear all variables including integers.
*EDIT	Enter full screen editor.
*FREE	Display free memory and pseudo variables.
*HELP INFO	Display a screenful of useful system information.
*MEMORY	Display memory contents.
*MERGE	Merge a program in memory with one on disc/cassette.
*MOVE	Move program to run at specified address.
*NEW	As NEW, but can be issued from within a program.
*OFF	Cancel enhanced error handling.
*OLD	As OLD, but can be issued from within a program.
*ON	Auto error handling—enters editor at line in error.
*PACK	Efficient program compactor.
*RECOVER	Intelligently recover bad programs.
*RENUMBER	Allow partial renumbering.
*REPORT	Extended error reporting facility.
*SCREEN	Screen dump to cassette or disc.
*UTIL	Display utilities menu.
*UTIL 1	String search.
*UTIL 2	String search and replace.
*UTIL 3	Move Basic program lines.
*UTIL 4	List procedures and functions.
*UTIL 5	List values of A% to Z%.
*UTIL 6	List numeric variables.
*UTIL 7	List string variables.
*UTIL 8	List names of arrays.
*UTIL 9	Set up range for utilities 1 and 2.

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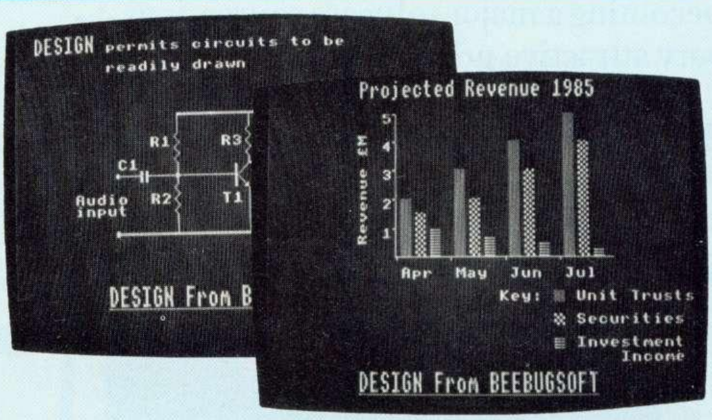
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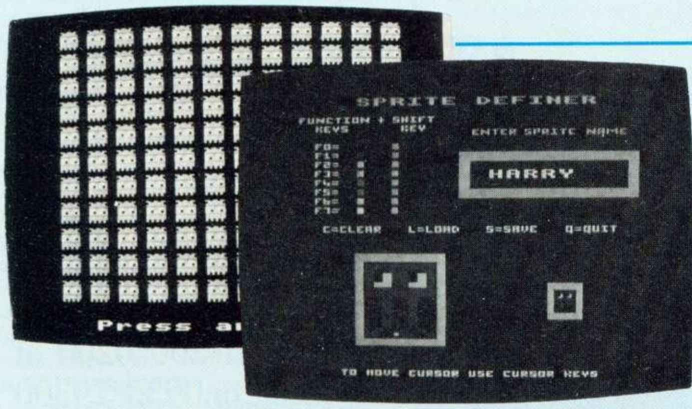
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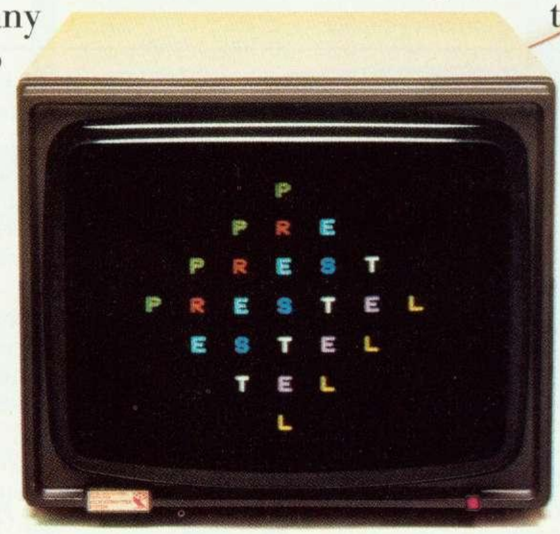
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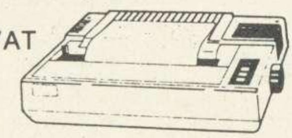
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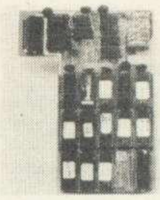


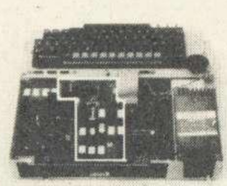
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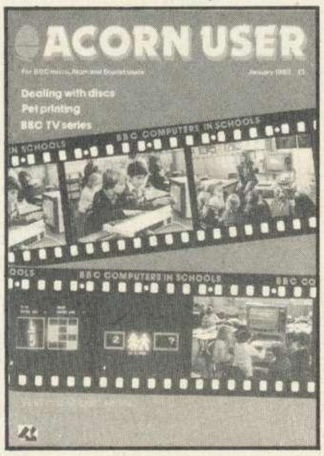
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6. January 1983 MEP school launch. *FX commands for sound. Second BBC TV series. Machine code 3 – two pass assembly. Disc drives for the Beeb. Programming forum. Program protection. Micros in schools – new series. Commodore Pet printer used with Beeb. BBC programs written on an Atom. Extra Atom memory.



7. February 1 MHz bus examined (4). 3D Atom graphics (3). Atom BBC Board reviewed (3). Machine code 4 – memory (5). BBC Computer Literacy update (1). Atom error handling (2). Micros in Schools 2 – getting organised (6). Hints and Tips (4). Beeb Forum (3). Reviews of *Wordwise* (2) and the Amber printer (1). ***

8. March Chess on the BBC micro (3). Sound on the Beeb (4). Printers for beginners (4). Atom analogue converter (2). Schools 3 – micros and maths (6). Machine code 5 – indirect addressing (3). DIY lightpen (5). MEP's *Microprimer* review (2). Atom Ross toolkit review (1). Beeb Forum (2). Assembly language and Pascal book reviews (2). ***

9. April *Hexangle* game listing (4). Bach on the Beeb (4). Hints & Tips on disc drives (4). Machine code 6 – the CALL statement (4). Interfacing the 1 MHz bus (3). Schools 4 – young children and micros (6). Graphics listings (2). Printers for beginners 2 (4). Reviews of BCPL, educational software and Atom software (3). ***

10. May Review of Basic II. Graphics listings. New *FX calls in OS1.2. Colour mixing on the Beeb. Jazz, blues and folk on the BBC. Schools 5 – language development. DIY Beeb interface box. Atom sound board. A to Z of printing: how to get going. Hints and Tips: PROCs, discs and FNs. Printer, software and book reviews.

11. June Techniques series – sorting. Hints and Tips: 50p network. Drawing techniques and CAD. Machine code: interrupts. Schools 6 – information technology. Atom Forum. Beeb Forum. Printers – write your own graphics dumps. Comparitive review of *View* and *Wordwise*. Three graphics packages reviewed. Test of *Acorn User*'s interface box.

12. July Techniques – hash tables. Hints and Tips: logic made easy. Recursion and graphics. Handling strings. Two ideas for passing variables. Beeb aids the blind. DIY second keyboard. Beeb Forum. Sounds on the Atom. Hardware, firmware, software and book reviews. Atom Forum.

13. August Printer graphics and dumps. Techniques – Tree structures and sorting. All the fun of the fair. 40/80 disc copier. Colour painting. Basic II: random access files. Screen dumps for Olivetti, Centronics and Seikosha. Atom strings. Reviews of Tandy CGP115 printer, five educational packs, A to D converter.

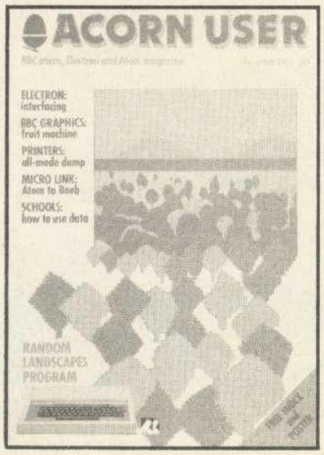
14. September Techniques – ink-blots and mazes. Painting by lightpen. DFS space explored. Beeb Forum. *Mega Monsters* game listing. Machine code graphics dumps. Atom Forum. Atom cassette recorder check. Reviews of Atom RAM boards, Cumana disc manual, *Logo* for schools, Hobbit floppy tape and books.

15. October Women and computing. Techniques – random numbers. Review of Computer Concepts' *Beebcalc*. Fractal graphics. 57 files on 40 & 80 track discs. *Vampire* game listing. Beeb Forum. Assembly code controls tab key. Osfile merging. Atom future. Atom verify routine. Reviews of *Vu-Type*, Procyon Atom book, Epson FX80, Teletext adapter, disc drive, software.

16. November Techniques – impossible problems. Contour graphics. Connecting two Beebs together. XREF: sorts & lists variable, function and procedure names. Assembler ultilities in Basic II. OS, VDU, *FX, OSBYTE calls – **pull-out poster**. Disc overlays. Adding extra Atom commands. Reviews of 7 educational packs, Atom ROM, books, games.



17. December Random graphics. Animated graphics in colour. Techniques – graphs. Hints & Tips. Universal printer dump. 6522 connected to the Electron. Saving machine code. Beeb Forum. Graphics **pull-out poster**. **Index:** July 82–July 83. Forum Extra: EQUS. BBC helps the disabled. Schools – data processing. Transferring data between Beebs, Atoms . . . or Pets. Atom block demolition utility. Atom disassembler program. Reviews of software, books, educational programs from Chalksoft.



18. January 1984: Games special issue Techniques – graphs part 2. Stacks and queues, Basic and languages. Hints & Tips. Voice chip revealed. How to write games. Electron interfacing. Beeb Forum. Life graphics routines. *Defencecom* game listing. *The Train Game* listing. Machine code graphics. Where to put machine code. Schools – handling data. Juki daisywheel printer examined. Atom Forum and adventure. Reviews of ultilities, software, *Beeline* wordprocessor, educational packages, two chess programs.



19. February: Adventures special issue Techniques – efficient sorts. PROC for a numeric keypad on the Beeb keyboard. 12 graphics listings. Random access filing on disc. Locking files. MCP40 printer/plotter looked at. Hints & Tips. Beeb Forum. Make discs readable on 40 and 80 track drives. Screen memory organisation. Hints on adventure design. Adventure action. Adventure ideas in computer language. Text compression. Word-crunching. VIA chip on Electron to drive a parallel printer. Atom Forum. Schools – simulation packages. Reviews: *Disc Doctor*, Leasalink's DFS upgrade, Hitachi's microdrive system, Solidisk's sideway RAM board, software.

20. March Utility: timing routine. Fractals. Teletext and mode 7 dump. ROMs reviewed. Hints & Tips. Beeb Forum. Add sounds to your games. Learn Lisp 1. Cube graphics. Printer driver for View. Basic II from Basic I. Beeb's ADC chip. Atom Forum. Listing formatter for the Atom. Atom 'bytes free' routine. Schools – test of *Factfile*. Keyboard skills. Amcom DFS v Acorn DFS. Reviews: *Beebpen* wordprocessor, Atom expansion system, software, books.

21. April Beeb graphics on TV. 6845 chip explored. Advanced filing systems. Lisp 2. Hints & Tips. Beeb Forum. Choose disc tracks to copy. Function key editing. Teletext dumps. CES scrutinised. Passing variables. Computer Concepts' graphics ROM. Schools – simulations. Calculating Easter dates. Better programming. Atom Forum. Atom ROM routines. Converting BBC to Atom Basic. Three printers compared. Reviews: software, Aries B20 RAM board, *Toolkit*, Monitors.

22. May Bitstik graphics system. Hints & Tips. 6502 second processor examined. Lisp 3. Beeb Forum. Disc utility to keep track of available space. Statistics. Pattern graphics. OSWORD explained. 4 colour graphics listings. Second-hand disc drives. Education – do girls get a fair deal? Atom Forum. BBC to Atom Basic 2. Reviews: British Micro's Grafpad, *Edword* wordprocessor, 4 sprite generators, Opus microdrive, Beasty, software.

23. June Acorn Z80 second processor. Forth. Graphics to brighten up your games. Soft Pottery graphics. Go faster and save memory space. Rapid search and load routine for tapes. How the Beeb and Electron work 1. Business: reviews and how to gently enter office computerisation. Education – adult literacy. Dumping Atom programs on the BBC. Atom Forum. Software copyright laws. Hints & Tips. Techniques – B-Trees. Beeb Forum. Reviews of monitors, printers, books, software, adventures, EPROM programmer.



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SWORD MASTER is one of the few two-player games around, and is designed for joystick or keyboard.

Sword Master by Ken Worrall is based on the fencing rules written in 1190 by Herman von Salza for the Deutscritter Order of Teutonic Knights. It features full-colour machine code animation of a sword duel between two knights.

'A quality game with high class graphics . . . one of the most enjoyable games I have played' – **Home Computer Weekly**
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TREK was the first game to take advantage of **voice synthesis** on the BBC micro – and uses joystick or keyboard.

Trek puts you in charge of a Starship with the task of wiping out an alien fleet. It's an excellent adaptation of the classic game with 7 screen displays, 3 on-board computers and 2 weapon systems.

Versions have been written for BBC micro and Electron to use both machines to their full. The BBC tape uses voice synthesis (if the chips are fitted).

The game has been extensively developed from Tim Heaton's famous Trek III. It barely fits into 32K.

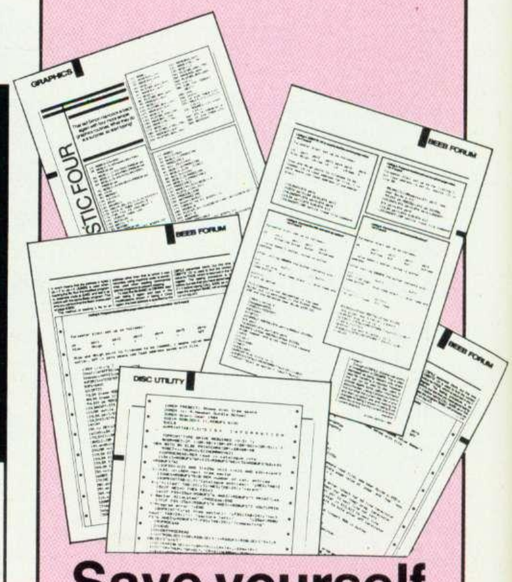
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Save yourself the time and bother of typing in Acorn User listings

ORDER FORM ON PAGE 95

See 'Now it's in the Can', page 46



```
 10 REM *** FLIES 2 ***
 15 REM ***(c) Acorn User Oct.84***
 20 MODE 4
 25 VDU 19,0,4;0;
 30 PROCsetup
 35 PROCcanister
 40 REPEAT
 45  start=0 : finish=24 : step=1
 50  PROCfly
 55  IF dead_flag=0 THEN END
 60  start=24: finish=0 : step=-1
 65  PROCfly
 70  IF dead_flag=0 THEN END
 75 UNTIL 0
 80 :
 85  *** procedures here ***
 90 :
 95 DEF PROCfly
100 FOR pos=start TO finish STEP step
105 xpos=RND(7)+2
110 *FX19
115 PRINTTAB(pos,xpos);CHR$(224)
120 SOUND0,-15,2,1
125 key$=INKEY$(0)
130 *FX19
135 IF key$=" " THEN PROCfire
140 IF key$=CHR$(139) THEN PROCcanup
145 IF key$=CHR$(138) THEN PROCcandown
150 *FX21
155 FOR delay=0 TO 50 : NEXT
160 PRINTTAB(pos,xpos);" ";
165 IF dead_flag=1 NEXT
170 ENDPROC
175 :
180 :
185 DEF PROCdie
190 P=pos:pos=finish
195 dead_flag=0
200 *FX21,4
205 PRINTTAB(P,xpos);" ";
210 FOR down=3 TO 28
215 SOUND0,-15,3,1
220 PRINT TAB(P,down);CHR$(224)
225 FOR delay=0 TO 50 : NEXT
230 PRINT TAB(P,down);" ";
235 NEXT
240 *FX21,4
245 SOUND0,-15,6,10
250 PRINTCHR$(230);"Uhg!"
255 ENDPROC
260 :
265 :
270 DEF PROCcanister
275 PRINTTAB(xcan,ycan);CHR$(225);CHR$
(226)
280 PRINTTAB(xcan,ycan+1);CHR$(227);CH
R$(228)
285 PRINTTAB(xcan,ycan+2);CHR$(227);CH
R$(228)
```

Annotations:

- Lines 20–25: Select graphics mode 4 with a blue background
- Lines 30–35: Initialise screen display
- Lines 45–55: Fly moves right. If dead END
- Lines 60–70: Fly moves left. If dead END
- Lines 100–110: Move fly across screen and at random X position. *FX19 stops screen judder
- Lines 120–130: Make buzzing noise and test keyboard
- Lines 135–150: If space or ↑ or ↓ key pressed call correct procedure. *FX21 flushes keyboard buffer
- Lines 155–165: After a delay rub out fly with a space
- Lines 185–200: Fly dead. Clear flag and stop buzzing noise with *FX21, 4
- Lines 205–210: Start 'move fly down the screen' routine
- Line 215: Do dying noise
- Lines 220–235: Complete 'fly moving down the screen' and turn sound off
- Lines 240–245: Make a 'thud' and print dead fly
- Lines 275–285: Print fly spray can on right of screen





Continued ▶

◄ *Continued*



```
  290 ENDPROC
  295 :
  300 :
  305 DEF PROCcanup
```

```
  310 IF ycan=2 THEN ENDPROC
  315 PRINTTAB(xcan,ycan+2);"  "
  320 ycan=ycan-1
  325 PROCcanister
  330 ENDPROC
```

If can at Y tab 2 do nothing, otherwise rub out bottom of can and print it one position up

```
  335 :
  340 :
  345 DEF PROCcandown
  350 IF ycan=11 THEN ENDPROC
  355 PRINTTAB(xcan,ycan);"  "
  360 ycan=ycan+1
  365 PROCcanister
```

If can at Y tab 11 do nothing, otherwise rub out top of can and print it one position down

```
  370 ENDPROC
  375 :
  380 :
  385 DEF PROCfire
  390 *FX21
  395 PRINTTAB(pos+1,xpos);"help!"
  400 FOR shot=xcan-1 TO pos STEP -1
  405 PRINTTAB(shot,ycan);CHR$(229)
  410 FOR wait=0 TO 10 : NEXT
  415 PRINTTAB(shot,ycan);" "
  420 NEXT
```

Move spray across the screen until at position of fly

```
  425 squirts=squirts+1
  430 PRINTTAB(10,30);squirts
  435 PRINTTAB(pos+1,xpos);"      "
```

Update squirt count and erase 'Help!'

```
  440 IF ycan=xpos THEN PROCdie :END
  445 ENDPROC
```

If spray hits fly then kill fly



```
  450 :
  455 :
  460 DEF PROCsetup
  465 VDU 23,1,0;0;0;0;
```

Turn cursor off

```
  470 VDU 23,224,36,24,90,189,255,60,24,
36
```

Define fly

```
  475 VDU 23,225,3,7,31,31,7,7,7,15
  480 VDU 23,226,192,224,224,224,224,224
,224,240
  485 VDU 23,227,31,63,63,63,63,63,63,63

  490 VDU 23,228,248,248,248,248,248,248
,248,248
```

Define fly spray can

```
  495 VDU 23,229,160,84,170,85,168,80,16
0,0
  500 VDU 23,230,0,0,0,0,36,24,60,126
```

Define spray and dead fly

```
  505 *FX4,1
  510 xcan=32 : ycan=11 : dead_flag=1
  515 squirts=0
```

Make cursor keys produce ASCII codes and initialise variables

```
  520 PRINTTAB(2,30);"Squirts:";squirts
  525 PRINTTAB(10,0);"*** Flies Two ***"

  530 ENDPROC
```

Print headings





See pages 53 and 54

Listing 4. Envelope generator for the BBC

```
 10 REM Listing 4
 20 ON ERROR RUN
 30 MODE1
 40 PROCinitialise
 50 REPEAT
 60 PROCscreen
 70 PROCsound
 80 PROCinput
 90 UNTIL 0
100 :
110 DEFPROCinitialise
120 VDU19,0,2,0,0,0:REM Green background
130 VDU19,2,0,0,0,0:REM Colour 2 - black
140 VDU19,3,4,0,0,0:REM Colour 3 - blue
150 @%=4
160 T=2:PI1=0:PI2=0:PI3=0
170 PN1=0:PN2=0:PN3=0
180 AA=127:AD=-1:AS=0:AR=0
190 ALA=126:ALD=0:P=100:D=50
200 ENDPROC
210 :
220 DEFPROCscreen
230 CLS
240 PROCdouble("ENVELOPE DESIGNER",10,1)
250 COLOUR2:PRINT
260 PRINT"  T=Step length           1/255 = "T
270 COLOUR 1:PRINT
280 PRINT"PI1=Pitch Increment 1  -128/127 = "PI1
290 PRINT"PI2=Pitch Increment 2  -128/127 = "PI2
300 PRINT"PI3=Pitch Increment 3  -128/127 = "PI3
310 PRINT"PN1=Pitch Step No. 1      0/255 = "PN1
320 PRINT"PN2=Pitch Step No. 2      0/255 = "PN2
330 PRINT"PN3=Pitch Step No. 3      0/255 = "PN3
340 COLOUR 3:PRINT
350 PRINT" AA=Amplitude Attack      1/127 = "AA
360 PRINT" AD=Amplitude Decay    -127/127 = "AD
370 PRINT" AS=Amplitude Sustain    0/-128 = "AS
380 PRINT" AR=Amplitude Release    0/-128 = "AR
390 PRINT"ALA=Amp. Attack Level     0/126 = "ALA
400 PRINT"ALD=Amp. Decay Level      0/126 = "ALD
410 COLOUR 2:PRINT
420 PRINT"  P=Pitch                 0/255 = "P
430 PRINT"  D=Duration             -1/255 = "D
440 COLOUR 129:COLOUR 3:PRINT
450 PRINT"ENVELOPE1,";T",";PI1",";PI2",";PI3",";
460 PRINT;PN1",";PN2",";PN3",";AA",";AD",";AS",";
    AR",";ALA",";ALD
470 COLOUR 132
480 ENDPROC
490 :
500 DEFPROCsound
510 ENVELOPE1,T,PI1,PI2,PI3,PN1,PN2,PN3,AA,AD,
    AS,AR,ALA,ALD
520 SOUND &11,1,P,D
530 ENDPROC
540 :
550 DEFPROCinput
560 COLOUR 1:PRINT
570 PRINT"     Press return for repeat note"
580 COLOUR 3:PRINT
590 INPUT"Change which parameter? "Q$
600 IFQ$="T" THEN INPUT"Value for T "T
610 IFQ$="PI1" THEN INPUT"Value for PI1 "PI1
620 IFQ$="PI2" THEN INPUT"Value for PI2 "PI2
630 IFQ$="PI3" THEN INPUT"Value for PI3 "PI3
640 IFQ$="PN1" THEN INPUT"Value for PN1 "PN1
650 IFQ$="PN2" THEN INPUT"Value for PN2 "PN2
660 IFQ$="PN3" THEN INPUT"Value for PN3 "PN3
670 IFQ$="AA" THEN INPUT"Value for AA "AA
680 IFQ$="AD" THEN INPUT"Value for AD "AD
690 IFQ$="AS" THEN INPUT"Value for AS "AS
700 IFQ$="AR" THEN INPUT"Value for AR "AR
710 IFQ$="ALA" THEN INPUT"Value for ALA "ALA
720 IFQ$="ALD" THEN INPUT"Value for ALD "ALD
730 IFQ$="P" THEN INPUT"Value for P "P
740 IFQ$="D" THEN INPUT"Value for D "D
750 ENDPROC
760 :
770 DEFPROCdouble(A$,x,y)
780 X%=0:Y%=13:A%=10:d=&D00
790 C$=CHR$(240)+CHR$8+CHR$10+CHR$(241)
800 FOR N=1 TO LEN(A$)
810 B$=MID$(A$,N,1):?d=ASC(B$):CALL&FFF1
820 VDU23,240,d?1,d?1,d?2,d?2,d?3,d?3,d?4,d?4
830 VDU23,241,d?5,d?5,d?6,d?6,d?7,d?7,d?8,d?8
840 PRINT TAB(x+N-1,y)C$:NEXT N
850 ENDPROC
```

Listing 5. Envelope generator for the Electron

```
 10 REM Listing 5
 20 ON ERROR RUN
 30 MODE1
 40 PROCinitialise
 50 REPEAT
 60 PROCscreen
 70 PROCsound
 80 PROCinput
 90 UNTIL 0
100 :
110 DEFPROCinitialise
120 VDU19,0,2,0,0,0:REM Green background
130 VDU19,2,0,0,0,0:REM Colour 2 - black
140 VDU19,3,4,0,0,0:REM Colour 3 - blue
150 @%=4
160 T=2:PI1=0:PI2=0:PI3=0
170 PN1=0:PN2=0:PN3=0
180 AA=126:AD=0:AS=0:AR=-126
190 ALA=126:ALD=126:P=100:D=50
200 ENDPROC
210 :
220 DEFPROCscreen
230 CLS
240 PROCdouble("ENVELOPE DESIGNER",10,1)
250 COLOUR2:PRINT
260 PRINT"  T=Step length           1/255 = "T
270 COLOUR 1:PRINT
280 PRINT"PI1=Pitch Increment 1  -128/127 = "PI1
290 PRINT"PI2=Pitch Increment 2  -128/127 = "PI2
300 PRINT"PI3=Pitch Increment 3  -128/127 = "PI3
310 PRINT"PN1=Pitch Step No. 1      0/255 = "PN1
320 PRINT"PN2=Pitch Step No. 2      0/255 = "PN2
330 PRINT"PN3=Pitch Step No. 3      0/255 = "PN3
340 COLOUR 2:PRINT
350 PRINT"  P=Pitch                 0/255 = "P
360 PRINT"  D=Duration             -1/255 = "D
370 COLOUR 129:COLOUR 3:PRINT
380 PRINT"ENVELOPE1,";T",";PI1",";PI2",";PI3",";
390 PRINT;PN1",";PN2",";PN3",";AA",";AD",";
    AS",";AR",";ALA",";ALD
400 COLOUR 132
410 ENDPROC
420 :
430 DEFPROCsound
440 ENVELOPE1,T,PI1,PI2,PI3,PN1,PN2,PN3,AA,
    AD,AS,AR,ALA,ALD
450 SOUND &11,1,P,D
460 ENDPROC
470 :
480 DEFPROCinput
490 COLOUR 1:PRINT
500 PRINT"     Press return for repeat note"
510 COLOUR 3:PRINT
520 INPUT"Change which parameter? "Q$
530 IFQ$="T" THEN INPUT"Value for T "T
540 IFQ$="PI1" THEN INPUT"Value for PI1 "PI1
550 IFQ$="PI2" THEN INPUT"Value for PI2 "PI2
560 IFQ$="PI3" THEN INPUT"Value for PI3 "PI3
570 IFQ$="PN1" THEN INPUT"Value for PN1 "PN1
580 IFQ$="PN2" THEN INPUT"Value for PN2 "PN2
590 IFQ$="PN3" THEN INPUT"Value for PN3 "PN3
600 IFQ$="P" THEN INPUT"Value for P "P
610 IFQ$="D" THEN INPUT"Value for D "D
620 ENDPROC
630 :
640 DEFPROCdouble(A$,x,y)
650 X%=0:Y%=13:A%=10:d=&D00
660 C$=CHR$(240)+CHR$8+CHR$10+CHR$(241)
670 FOR N=1 TO LEN(A$)
680 B$=MID$(A$,N,1):?d=ASC(B$):CALL&FFF1
690 VDU23,240,d?1,d?1,d?2,d?2,d?3,d?3,d?4,d?4
700 VDU23,241,d?5,d?5,d?6,d?6,d?7,d?7,d?8,d?8
710 PRINT TAB(x+N-1,y)C$:NEXT N
720 ENDPROC
```

See 'Fatman on the Move', page 65

Harry Sinclair's 'Design' program last month enabled you to create your own sprite cartoon characters. This program, 'Mover', lets you move them about the screen and animate them

```
   10*TV255
   20REM*LO.DATANAME
   30*T.
   40MODE2
   50PROCASS
   60COLOUR138:PRINTTAB(6,1)"          ":COLOUR0:PRINTTAB(6,2)" MOVER ";TAB(6,3)"
     ":COLOUR128
   70COLOUR6
   80PRINTTAB(4,7)"Do you want:"''':COLOUR8:PRINT"1.";:COLOUR6:PRINT"8 frame ani
mation";''':COLOUR15:PRINT"2.";:COLOUR6:PRINT"Single character"'''TAB(2)"movemen
t"
   90*FX15
  100COLOUR3:PRINT'''"Please choose.";:REPEAT PRINTTAB(16,22)CHR$127;:INPUTTAB(1
4,22)" "G:UNTILG=1 OR G=2:COLOUR6
  110*FX15
  120IF G=1 ?&74=1 ELSE ?&74=0
  130IF G=2 PRINT'''"Character number?";:REPEAT PRINTTAB(18,26)"  ";:INPUTTAB(17
,26)" "G:UNTIL G>=0 AND G<9:?&70=G
  140CLS
  150*FX15
  160PRINTTAB(4,12)"what delay ?":INPUTTAB(3,15)"(0 = no delay)"del%
  170CLS
  180VDU23,1,0;0;0;0;
  190PRINTTAB(0,8)"Cursor keys control"'''"character movement."
  200COLOUR2:PRINTTAB(0,15)"ESCAPE to exit."
  210COLOUR5:PRINTTAB(0,22)"SPACE to continue...":COLOUR12
  220REPEAT UNTIL GET=32
  230CLS
  240FORI%=0 TO 200:Q%=RND(20000)+&3000:?Q%=&2A:NEXT:PRINTTAB(6,14)"MOVER!!"
  250IF?&74=1 ?&70=0
  260?&71=40:?&72=100
  270?&76=del%-1
  280CALL cv
  290CALL first
  300CALL start
  310COLOUR7
  320END
  330DEFPROCASS
  340FORI%=0TO2STEP2
  350P%=&E00
  360[OPTI%
  370.Leftpressed
  380LDA&71
  390BEQ limit
  400DEC&71
  410LDA&74
  420BEQ draw  \
    no animation
  430LDA£1
  440STA&75
  450JSR animation
  460.draw
  470JSR mover
  480.limit
  490RTS
  500.Rightpressed
  510LDA&71
  520CLC
  530CMP&7A
  540BEQ limit
  550INC&71
  560LDA&74
  570BEQ draw  \
    no animation
  580LDA£0
  590STA&75
  600JSR animation
  610JMP draw
  620.Downpressed
  630LDA&72
  640CMP£228
  650BEQ limit
  660CLC
  670ADC£4
  680STA&72
  690JMP draw
  700.Uppressed
  710LDA&72
  720BEQ limit
  730SEC
  740SBC£4
  750STA&72
  760JMP draw
  770.animation
  780LDA&75
  790BEQ right
  800LDA&71
  810AND£3
  820CLC
  830ADC£4
  840STA&70
  850BNE finished
  860.right
  870LDA&71
  880AND£3
  890STA&70
  900.finished
  910RTS
  920.mover
  930.speedcontrol
  940LDX&76
  950BMI fast
  960.delay
  970LDA&77
  980.check
  990CMP&77
 1000BEQ check
 1010DEX
 1020BPL delay
 1030.fast
 1040JMP display
 1050.nv
 1060PHP
 1070DEC&77
 1080PLP
 1090RTS
 1100.cv
 1110LDA&220
 1120STA olv
 1130LDA&221
 1140STA olv+1
 1150SEI
 1160LDA £nv MOD256
 1170STA&220
 1180LDA £nv DIV256
 1190STA&221
 1200CLI
 1210LDA£14
 1220LDX£4
 1230JSR &FFF4
 1240LDA&12EF
 1250STA&78
 1260SEC
 1270SBC£8
 1280STA&79
 1290LDA&78
 1300STA Rblock2+1
 1310STA b2+3
 1320CLC
 1330ADC&78
 1340STA Rblock3+1
 1350STA b3+3
 1360CLC
 1370ADC&78
 1380STA Rblock4+1
 1390STA b4+3
 1400LDA&78
 1410LSRA
 1420LSRA
 1430LSRA
 1440STA&7A
 1450LDA£&50
 1460SEC
 1470SBC&7A
 1480STA&7A
 1490RTS
 1500.start
 1510LDY£2
 1520LDA£Leftpressed
      MOD256
 1530STA tbl,Y
 1540INY
 1550LDA£Leftpressed
      DIV256
 1560STA tbl,Y
 1570INY
 1580LDA£Rightpressed
      MOD256
 1590STA tbl,Y
 1600INY
 1610LDA£Rightpressed
      DIV256
 1620STA tbl,Y
 1630INY
 1640LDA£Downpressed
      MOD256
 1650STA tbl,Y
 1660INY
 1670LDA£Downpressed
      DIV256
 1680STA tbl,Y
 1690INY
 1700LDA£Uppressed
      MOD256
 1710STA tbl,Y
 1720INY
 1730LDA£Uppressed
      DIV256
 1740STA tbl,Y
 1750.keycheck
 1760LDA&ED
 1770BEQ checkEC
 1780JSR keyvalid
 1790BEQ checkEC
 1800JSR getaddress
 1810JSR gotomover
 1820.checkEC
 1830LDA&EC
 1840BEQ keycheck
 1850JSR keyvalid
 1860BEQ keycheck
 1870JSR getaddress
 1880JSR gotomover
 1890JMP keycheck
 1900.keyvalid
 1910CMP£&F0
 1920BNE checkleft
 1930PLA
 1940PLA
 1950JMP escape
 1960.checkleft
 1970CMP£&99
 1980BNE checkright
 1990LDA£1
 2000RTS
 2010.checkright
 2020CMP£&F9
 2030BNE checkdown
 2040LDA£2
 2050RTS
```

RUNNING 'MOVER'

THE listing can be broken down into two sections: Basic and assembler. A prior knowledge of the latter is not necessary for entering the program – just type it in exactly as you see it. Before starting ensure that PAGE has been set to &1900, whether you have tape or disc. To do this type:

```
PAGE = &1900 <return>
NEW <return>
```

You'll find it much easier to enter the assembler listing first. For tips on doing this see yellow page X in last month's issue. Enter lines 330 to 4200 and then save what you have entered so far to tape or disc, just in case of accidents. Change line 340 to read:

```
FOR I% = 0 TO 3 STEP 3
```

Now add the following two lines:

```
1 PROCASS
2 END
```

Run the program and correct any syntax errors that occur, then add the following lines to your program:

```
1 PROCASS
2 Z% = 0
3 FOR N% = &E00 TO &1084
4 Z% = Z% + ?N%
5 NEXT
6 PRINT"CHECKSUM IS  :";Z%
7 END
```

Now re-run the program and after a short delay the result

CHECKSUM IS :73536

should be displayed. If this is not the case you have made a mistake in entering the assembler – so check again carefully!

If all is well re-enter line 340 as:

```
340 FOR I% = 0 TO 2 STEP 2
```

Now delete lines 1 to 7 inclusive and enter the rest of the listing, and you're ready.

CONVERTING FOR THE ELECTRON

MOVER will run on the Elk if a few alterations are made to the listing. The alterations are in the assembler as follows:

```
1970 CMP £&88
2020 CMP £&84
2070 CMP £&89
2120 CMP £&8D
2790 LDA &C36D,Y
2820 LDA &C36D,Y
```

The checksum value will be 73310.

```
2060.checkdown
2070CMP£&A9
2080BNE checkup
2090LDA£3
2100RTS
2110.checkup
2120CMP£&B9
2130BNE invalidkey
2140LDA£4
2150RTS
2160.invalidkey
2170LDA£0
2180RTS
2190.getaddress
2200ASLA
2210TAY
2220LDA tbl,Y
2230STA gotomover+1
2240INY
2250LDA tbl,Y
2260STA gotomover+2
2270RTS
2280.gotomover
2290JSR&8000
    dummy address
2300RTS
2310.escape
2320SEI
2330LDA olv
2340STA&220
2350LDA olv+1
2360STA&221
2370CLI
2380LDA£15
2390LDX£0
2400JSR&FFF4
2410RTS
2420.tbl
2430NOP:NOP:NOP:NOP
2440NOP:NOP:NOP
2450NOP:NOP:NOP
2460.olv
2470NOP:NOP
2480.display
2490LDY&78
2500DEY
2510.replace
2520LDA&C00,Y
2530STA(&80),Y
2540.Rblock2
2550LDA&C00,Y
2560STA(&82),Y
2570.Rblock3
2580LDA&C00,Y
2590STA(&84),Y
2600.Rblock4
2610LDA&C00,Y
2620STA(&86),Y
2630DEY
2640BPL replace
2650.first
2660LDA£0
2670STA&80
2680STA&82
2690LDA£&30
2700STA&81
2710LDA&72
2720AND£7
2730STA&73
2740EOR&72
2750LSRA
2760LSRA
2770TAY
2780INY
2790LDA&C375,Y
2800STA&80
2810DEY
2820LDA&C375,Y
2830CLC
2840ADC&81
2850STA&81
2860LDA&71
2870LDX£3
2880.LOOP
2890ASLA
2900ROL&82
2910DEX
2920BNE LOOP
2930ADC&80
2940STA&80
2950LDA£0
2960ADC&82
2970ADC&81
2980STA&81
2990LDA£&80
3000CLC
3010ADC&80
3020STA&82
3030LDA£2
3040ADC&81
3050STA&83
3060LDA£&80
3070CLC
3080ADC&82
3090STA&84
3100LDA£2
3110ADC&83
3120STA&85
3130LDA£&80
3140CLC
3150ADC&84
3160STA&86
3170LDA£2
3180ADC&85
3190STA&87
3200LDA£8
3210SEC
3220SBC&73
3230STA&73
3240LDA&70
3250ASLA
3260TAY
3270LDA&12F0,Y
3280CLC
3290ADC&73
3300LDX£0
3310STA&88,X
3320CLC
3330.loop
3340ADC&78
3350INX
3360INX
3370CPX£8
3380BCS ex
3390STA&88,X
3400BCC loop
3410.ex
3420CLC
3430INY
3440LDA&12F0,Y
3450LDX£0
3460.loop2
3470STA&89,X
3480INX
3490INX
3500CPX£8
3510BCC loop2
3520LDY&78
3530INC&73
3540LDX&73
3550.ml
3560TYA
3570BEQ co
3580AND£7
3590BNE mi
3600TXA
3610BPL sa
3620LDX£6
3630.hi
3640LDA&88,X
3650CLC
3660ADC&79
3670STA&88,X
3680DEX
3690DEX
3700BPL hi
3710.sa
3720LDX&73
3730.mi
3740DEX
3750BNE sh
3760LDX£6
3770.lo
3780LDA&88,X
3790SEC
3800SBC&79
3810STA&88,X
3820DEX
3830DEX
3840BPL lo
3850.sh
3860DEY
3870LDA(&80),Y
3880STA&C00,Y
3890TXA
3900BMI b2
3910LDA(&88),Y
3920BEQ b2
3930STA(&80),Y
3940.b2
3950LDA(&82),Y
3960STA&C00,Y
3970LDA(&8A),Y
3980BEQ b3
3990STA(&82),Y
4000.b3
4010LDA(&84),Y
4020STA&C00,Y
4030LDA(&8C),Y
4040BEQ b4
4050STA(&84),Y
4060.b4
4070LDA(&86),Y
4080STA&C00,Y
4090TXA
4100BPL mle
4110LDA(&8E),Y
4120BEQ mle
4130STA(&86),Y
4140.mle
4150JMP ml
4160.co
4170RTS
4180]
4190NEXT
4200ENDPROC
```

See 'Take Command of the 8271 Chip', page 81

Listing 1. Disc copying program by Richard Harris. It will make back-up copies of most – if not all – discs. With minor modification (see page 86) it can also be used to change protected discs

```
   10 DIM SIZE%(4),gap%(4),block% 30,dat
a% 2200
   15 MODE7
   20 PROCsetblock:PROCsetup
   25 FOR K%=0 TO 39:REM for 40 track dr
ive
   40 PROCseek(0,K%):PROCseek(1,K%):IF F
Nid(0,K%) THEN 110
   50 PROCsettr(?data%):PROCformat
   60 PROCvalues
   65 FOR S%=S% TO S%+s%-1:REM for all s
ectors on track
   66 REM assumes consequetive numbered
sectors; may need changing for some disc
s
   70 D%=FNload(0,T%,S%):REM load from d
rive 0
   80 PROCsave(1,T%,S%,D%):REM copy onto
 drive 1
   85 NEXT
   90 PROCsettr(K%)
  100 J%=FNid(1,K%)
  110 NEXT
  980 STOP
  990
 1000 DEF PROCsetblock:REM set up OSWORD
 parameters
 1010 ?block%=0:block%!1=data%
 1020 X%=block%MOD256:Y%=block%DIV256
 1030 ENDPROC
 1040
 1200 DEF PROCseek(dri%,tr%)
 1210 ?block%=dri%:block%?5=1:block%?6=&
69
 1220 block%?7=tr%
 1230 PROCdisc(8)
 1240 ENDPROC
 1250
 1400 DEF PROCdisc(J%):REM call OSWORD
 1410 A%=&7F
 1420 CALL &FFF1
 1430 IF block%?J% PRINTTAB(10,22)"èErro
r number ";block%?J%:PRINTTAB(10,24)"¿PR
ESS SPACE":VDU7:REPEAT UNTIL GET=32
 1435 REM ignore deleted data and track
not found (may not be on disc): other er
rors probably fatal
 1440 ENDPROC
 1450
 1600 DEF FNid(dri%,tr%):REM reads one t
hen all ID fields on track
 1610 block%?5=3:block%?6=&5B:block%?7=t
r%:block%?8=0:block%?9=1
 1620 ?block%=dri%
 1630 PROCdisc(10):IF block%?10<>0 =1:RE
M escape if track not present
 1640 size%=data%?3:s%=SIZE%(size%)
 1650 block%?9=s%
 1660 CLS:PROCdisc(10)
 1670 FOR J%=0 TO (s%-1)*4 STEP 4
 1680 PRINT"track ";data%?J%;" sector ";
data%?(J%+2);" size ";data%?(J%+3)
 1690 NEXT
 1700 =0
 1710
 1800 DEF PROCsettr(J%):REM change curre
nt track registers
 1810 block%?5=2:block%?6=&3A:block%?7=&
12:block%?8=J%
 1820 PROCdisc(9)
 1830 block%?7=&1A:PROCdisc(9)
 1840 ENDPROC
 1850
 2000 DEF PROCformat:REM formats with sa
me ID fields as read in from first disc
 2010 block%?0=1:block%?5=5:block%?6=&63
:block%?7=?data%:block%?8=gap%(size%):bl
ock%?9=(size%*32)+s%:block%?10=0:block%?
11=16
 2020 PROCdisc(12)
 2030 ENDPROC
 2040
 2200 DEF PROCvalues
 2210 T%=?data%:S%=255
 2220 FOR J%=2 TO (s%-1)*4+2 STEP 4
 2230 IF data%?J%<S% S%=data%?J%
 2240 NEXT
 2245 REM sets T% to logical track, S% t
o lowest logical sector number
 2250 ENDPROC
 2260
 2400 DEF FNload(F%,G%,H%)
 2410 ?block%=F%:block%?5=3:block%?6=&57
 2420 block%?7=G%:block%?8=H%:block%?9=(
size%*32)+1
 2430 PROCdisc(10)
 2440 IF block%?10=&20 =1:REM if deleted
 data found
 2450 =0:REM if normal data
 2460
 2600 DEF PROCsave(F%,G%,H%,I%)
 2610 ?block%=F%:block%?5=3
 2620 block%?7=G%:block%?8=H%:block%?9=(
size%*32)+1
 2630 IF I% block%?6=&4F ELSE block%?6=&
4B
 2640 PROCdisc(10)
 2650 ENDPROC
 2660
 5000 DEF PROCsetup
 5010 FOR J%=0 TO 4
 5020 READ SIZE%(J%),gap%(J%)
 5030 NEXT
 5040 DATA 18,11,10,21,5,74,2,255,1,0
 5050 ENDPROC
 5060
```

See page 114

Listing 2. Alan Crabb's program reads a disc's catalogue and prints the load/exec/length values of all the files

```
  10 REM ****************************
  20 REM **        READ FILES      **
  30 REM **                        **
  40 REM ** Copyright (C) A.M.CRABB **
  50 REM **       23 July 1984     **
  60 REM **      for ACORN USER    **
  70 REM ****************************
  80
  90 REM Resevre workspace
 100 DIM cli 6,space &11,files &D8
 110 REM Define array for filenames
 120 DIM file$(30)
 130
 140 REM Define OS call addresses
 150 oscli=&FFF7
 160 osword=&FFF1
 170 osfile=&FFDD
 180 osgbpb=&FFD1
 190
 200 REM Read disc 'cycle number'
 210 ?space=0 :REM Drive number
 220 A%=&7D
 230 X%=space MOD 256
 240 Y%=space DIV 256
 250 CALL osword
 260 REM returned in space?0
 270
 280 REM No files yet
 290 numfile=TRUE
 300
 310 REM Read on all directories as
 320 REM osgbpb reads only current
 330 REM directory
 340 FOR dir=33 TO 96
 350
 360 REM Check for " and : - illegal
 370 IF dir=34 OR dir=58 GOTO 770
 380
 390 REM Perform *DIR
 400 $cli="*DIR "+CHR$ dir
 410 X%=cli MOD 256
 420 Y%=cli DIV 256
 430 CALL oscli
 440
 450 REM Set up parameter block
 460 space!1=files
 470 space!5=31 :REM Max no. files
 480 space!9=0
 490 REM Call reads files on directory
 500 A%=8
 510 X%=space MOD 256
 520 Y%=space DIV 256
 530 CALL osgbpb
 540
 550 numofiles=30-space!5
 560 REM No files on directory
 570 IF numofiles=TRUE GOTO 770
 580
 590 REM Read each file, stored as
 600 REM length of name, name
 610 point=files
 620 FOR file=0 TO numofiles
 630 length=?point
 640 A$=""
 650 FOR char=1 TO length
 660 A$=A$+CHR$(char?point)
 670 NEXT
 680
 690 REM 1 more file, store in array
 700 numfile=numfile+1
 710 REM Add directory character
 720 A$=CHR$(dir)+"."+A$
 730 file$(numfile)=A$
 740 REM Move pointer to next file
 750 point=point+length+1
 760 NEXT
 770 NEXT
 780
 800 REM Print all file names
 810 FOR file=0 TO numfile
 820 PRINT file$(file);
 830 PRINT~FNldad(file$(file));
 840 PRINT~FNexad(file$(file));
 850 PRINT~FNlen(file$(file))
 860 NEXT
 870 END
 880
 890 REM ****************************
 900
1000 REM Returns load address of file
1010 DEF FNldad(A$)
1020 LOCAL A%,X%,Y%
1030 PROCread
1040 =space!2
1050
1060 REM Returns exec address of file
1070 DEF FNexad(A$)
1080 LOCAL A%,X%,Y%
1090 PROCread
1100 =space!6
1110
1120 REM Returns length of file
1130 DEF FNlen(A$)
1140 LOCAL A%,X%,Y%
1150 PROCread
1160 =space!10
1170
2000 REM Performs read addresses
2010 DEF PROCread
2020 !space=files
2030 $files=A$
2040 A%=5
2050 X%=space MOD 256
2060 Y%=space DIV 256
2070 CALL osfile
2080 ENDPROC
```

See 'See How They Sort', page 117

Program 1. Select a sort from the menu and watch the sorting process, colour-coded to make it easy to follow

```
   10 REM *** ALLSORT ***
   20 REM G.B.HILL 1984
   30 REM version 6
   40 ON ERROR GOTO 340
   50 MODE 7
   60 REM*** MAIN PROGRAM ***
   70
   80 PROCsetup
   90 REPEAT
  100 FOR I=1 TO max:dest$(I)=source$(I):NEXT
  110 PROCmenu
  120 IF choice=1 THEN PROCbubble
  130 IF choice=2 THEN PROCshuttle
  140 IF choice=3 THEN PROCinsertion
  150 IF choice=4 THEN PROCselection
  160 IF choice=5 THEN PROCshell
  170 IF choice=6 THEN PROCquick(1,max)
  180 IF choice=7 THEN PROCtree
  190 IF choice<>num_of_sorts THEN PROCwait
  200 UNTIL choice=num_of_sorts
  210 VDU26,12,23,1,1;0;0;0;
  220 PRINT'"RETURNED TO"''"BASIC"'
  230 END
  240
  250 REM *** DATA ***
  260
  270 DATA BUBBLE,SHUTTLE,INSERTION,SELECTION,SHEL
L,QUICK,TREE,END.
  280
  290 DATA FRED,GEORGE,ALEX,JOE,BERT,BERNARD,HARRY
,ZEBIDEE,PETER
  300 DATA JEREMY,GEORGE,PETER,JIM,SIMON,TONY,JOHN
,***
  310
  320 REM *** PROCEDURES ***
  330
  340 REM ERROR ROUTINE
  350 IF ERR=17 THEN RUN
  360 REPORT
  370 PRINT" at line ";ERL'
  380 END
  390
  400 DEFPROCsetup
  410 waittime=100
  420 T=TRUE:F=FALSE
  430 nothing=128:red=129:green=130:yellow=131:blu
e=132:magenta=133:cyan=134:white=135
  440 DIM source$(100),dest$(100),sort$(20)
  450 RESTORE 270
  460 I=0
  470 REPEAT
  480 I=I+1
  490 READ sort$(I)
  500 UNTIL sort$(I)="END."
  510 num_of_sorts=I
  520 RESTORE 290
  530 I=0
  540 REPEAT
  550 I=I+1
  560 READ source$(I)
  570 UNTIL source$(I)="***"
  580 max=I-1
  590 ENDPROC
  600
  610 DEFPROCmenu
  620 PROCdouble("MENU for")
  630 FOR I=1 TO num_of_sorts
  640 PRINTTAB(4,I+2);STR$I;" ";sort$(I)
  650 NEXT
  660 VDU23,1,1;0;0;0;10,13
  670 choice=FNchoose("1 to "+STR$num_of_sorts)
  680 IF choice=num_of_sorts THEN ENDPROC
  690 VDU23,1,0;0;0;0;
  700 PROCdouble(sort$(choice))
  710 FORI=1 TO max:PRINTTAB(8,I+1);source$(I):NEX.
T
  720 PROClist
  730 ENDPROC
  740
  750 DEFPROCdouble(d$)
  760 LOCAL d
  770 d=(40-LENd$-9) DIV 2
  780 VDU26,12:PRINTTAB(d,2);CHR$cyan;CHR$141;d$;C
HR$yellow;"SORT"
  790 PRINTTAB(d,3);CHR$cyan;CHR$141;d$;CHR$yellow
;"SORT"
  800 VDU28,0,23,39,4
  810 ENDPROC
  820
  830 DEFPROCwait
  840 PROCsection(1,max,white)
  850 PRINTTAB(0,19);CHR$133;"Press SPACE bar to c
ontinue.";:REPEAT:UNTIL GET=32
  860 ENDPROC
  870
  880 DEFFNchoose(M$)
  890 REPEAT
  900 PRINT"
";:VDU13
  910 PRINT"Type ";M$;" then <RETURN> ";
  920 INPUT""n$
  930 ln=VAL(LEFT$(M$,1))
  940 IF VAL(RIGHT$(M$,3))=0 THEN rn=VAL(RIGHT$(M$
,2)) ELSE rn=VAL(RIGHT$(M$,3))
  950 ok=ASCn$<58 AND VALn$>=ln AND VALn$<=rn AND
VALn$=INT(VALn$)
  960 IF NOT ok THEN VDU7,11,13:FOR I=1 TO 39:VDU3
2:NEXT:VDU13
  970 UNTIL ok
  980 =VALn$
  990
 1000 DEFPROCswap(i,j)
 1010 sorted=FALSE
 1020 spare$=dest$(i)
 1030 dest$(i)=dest$(j)
 1040 dest$(j)=spare$
 1050 PRINTTAB(21,i+1);dest$(i);"    "
 1060 PRINTTAB(21,j+1);dest$(j);"    "
 1070 PROCmark(i,j,cyan,T)
 1080 ENDPROC
 1090
 1100 DEFPROClist
 1110 LOCAL II
 1120 FOR II=1 TO max
 1130 PRINTTAB(21,II+1);dest$(II);"    "
 1140 NEXT
 1150 ENDPROC
 1160
 1170 DEFPROCmark(i,j,colour,pause)
 1180 PRINTTAB(20,i+1);CHR$colour;TAB(20,j+1);CHR$
colour
 1190 IF pause THEN PROCpause:PROCmark(i,j,nothing
,F)
 1200 ENDPROC
 1210
 1220 DEFPROCpause
 1230 Z=INKEY(waittime)
 1240 *FX15,1
 1250 ENDPROC
 1260
 1270 DEFPROCsection(i,j,colour)
 1280 FOR II=i TO j
 1290 PRINTTAB(18,II+1);CHR$colour;CHR$colour;CHR$
colour
 1300 NEXT
 1310 ENDPROC
 1320
 1330 DEFPROCbubble
 1340 FOR I=1 TO max-1
 1350 sorted=TRUE
 1360 FOR J=max TO I+1 STEP -1
 1370 PROCmark(J-1,J,green,T)
 1380 IF dest$(J-1)>dest$(J) THEN PROCswap(J,J-1)
 1390 NEXT
 1400 IF sorted THEN I=max-1 ELSE PROCpause
 1410 NEXT
 1420 ENDPROC
 1430
 1440 DEFPROCshuttle
 1450 I=0
 1460 top=0:bottom=max:inc=1:sorted=TRUE
 1470 REPEAT
 1480 sorted=TRUE
 1490 REPEAT
```

```
 1500 I=I+inc
 1510 PROCmark(I,I+1,green,T)
 1520 IF dest$(I)>dest$(I+1) THEN PROCswap(I,I+1)
 1530 IF I+inc=top THEN top=top+1:inc=1
 1540 IF I+inc=bottom THEN bottom=bottom-1:inc=-1
 1550 UNTIL I=top OR I=bottom
 1560 UNTIL bottom<=top+1 OR sorted
 1570 ENDPROC
 1580
 1590 DEFPROCinsertion
 1600 FOR I=2 TO max
 1610 PROCpause
 1620 PRINTTAB(19,I);" ";TAB(19,I+1);"]"
 1630 FOR J=I TO 2 STEP -1
 1640 PROCmark(J-1,J,green,T)
 1650 IF dest$(J-1)>dest$(J) THEN PROCswap(J,J-1)
ELSE J=2
 1660 NEXT
 1670 NEXT
 1680 ENDPROC
 1690
 1700 DEFPROCselection
 1710 FOR I=1 TO max-1
 1720 lowindex=I
 1730 PRINTTAB(19,I);" ";TAB(19,I+1);"]";CHR$yello
w;
 1740 FOR J=I+1 TO max
 1750 PROCmark(0,J,green,T)
 1760 IF dest$(J)<dest$(lowindex) THEN PROCmark(0,
lowindex,white,F):lowindex=J
 1770 PROCmark(0,lowindex,yellow,F)
 1780 NEXT
 1790 IF lowindex<>I THEN PROCswap(I,lowindex) ELS
E PROCmark(0,I,white,F)
 1800 NEXT
 1810 ENDPROC
 1820
 1830 DEFPROCshell
 1840 inc=max DIV 2
 1850 REPEAT
 1860 IF inc<=0 THEN 1920
 1870 PROCpause
 1880 FOR I=inc+1 TO max
 1890 PROCpair(I,I-inc)
 1900 NEXT
 1910 inc=inc DIV 2
 1920 UNTIL inc<=0
 1930 ENDPROC
 1940
 1950 DEFPROCpair(i,j)
 1960 IF j<=0 THEN ENDPROC
 1970 PROCmark(i,j,green,T)
 1980 IF dest$(i)<dest$(j) THEN PROCswap(i,j):PROC
pair(j,j-inc)
 1990 ENDPROC
 2000
 2010 DEFPROCquick(i,j)
 2020 LOCAL pivotindex,partitionpoint,I
 2030 pivotindex=FNfindpivot(i,j)
 2040 PROCsection(1,max,white)
 2050 PROCsection(i,j,blue)
 2060 PRINTTAB(30,2);CHR$red;dest$(pivotindex);"
"
 2070 PROCpause
 2080 IF pivotindex=0 THEN ENDPROC
 2090 partitionpoint=FNpartition(i,j,pivotindex)
 2100 PROCquick(i,partitionpoint-1)
 2110 PROCquick(partitionpoint,j)
 2120 PRINTTAB(30,2);"          "
 2130 PROCsection(1,max,white)
 2140 ENDPROC
 2150
 2160 DEFFNfindpivot(i,j)
 2170 LOCAL I
 2180 I=i
 2190 IF I=j THEN =0
 2200 IF dest$(I)>dest$(I+1) THEN =I
 2210 IF I+1=j THEN =0
 2220 IF dest$(I)<dest$(I+1) THEN =I+1
 2230 I=I+1:GOTO 2190
 2240
 2250 DEFFNpartition(i,j,K)
 2260 pivot$=dest$(K)
 2270 L=i:R=j
 2280 REPEAT
 2290 PROCswap(L,R)
 2300 PROCmark(0,L,yellow,F):PROCmark(0,R,green,F)
:PROCpause
 2310 IF dest$(L)<pivot$ THEN PROCmark(0,L,nothing
,F):L=L+1:PROCmark(0,L,yellow,F):PROCpause:GOTO 23
10
 2320 IF L=R THEN 2340
 2330 IF dest$(R)>=pivot$ THEN PROCmark(0,R,nothin
g,F):R=R-1:PROCmark(0,R,green,F):PROCpause:IF R>L
THEN 2330
 2340 UNTIL L>=R
 2350 =L
 2360
 2370 DEFPROCtree
 2380 PROCcolour_tree
 2390 FOR I=2 TO max
 2400 PRINTTAB(18,I);" ";TAB(18,I+1);"]":PROCpause
 2410 PROCbackup(I)
 2420 NEXT
 2430 PROCcolour_tree
 2440 FOR I=max TO 2 STEP -1
 2450 PROCpause
 2460 test$=dest$(I)
 2470 PROCmove(I)
 2480 dest$(I)=" ***"
 2490 PROCswap(1,I)
 2500 PROCsection(I,max,white)
 2510 PROCpause
 2520 PROCputback(1)
 2530 NEXT
 2540 ENDPROC
 2550
 2560 DEFPROCbackup(J)
 2570 REPEAT
 2580 PROCmark(J,J DIV 2,green,T)
 2590 IF dest$(J)>dest$(J DIV 2) THEN PROCswap(J,J
DIV 2)
 2600 J=J DIV 2
 2610 UNTIL J=1
 2620 ENDPROC
 2630
 2640 DEFPROCputback(J)
 2650 LOCAL swapindex
 2660 swapindex=2*J
 2670 IF swapindex>=I THEN PROCswap_test:ENDPROC
 2680 IF dest$(swapindex)<dest$(swapindex+1) THEN
swapindex=swapindex+1
 2690 IF swapindex>=I THEN PROCswap_test:ENDPROC
 2700 IF test$>=dest$(swapindex) OR swapindex>=I T
HEN PROCswap_test  ELSE PROCmark(J,swapindex,green
,T):PROCswap(J,swapindex):PROCputback(swapindex)
 2710 ENDPROC
 2720
 2730 DEFPROCswap_test
 2740 dest$(J)=test$
 2750 PROCmark(0,J,cyan,F)
 2760 PRINTTAB(30,I+1);CHR$cyan;
 2770 PRINTTAB(20,J+1);CHR$cyan;dest$(J);"     "
 2780 PRINTTAB(31,I+1);" ***      "
 2790 PROCpause
 2800 PRINTTAB(20,J+1);CHR$nothing:
 2810 PRINTTAB(31,I+1);"          "
 2820 ENDPROC
 2830
 2840 DEFPROCmove(i)
 2850 LOCAL II
 2860 FOR II=20 TO 31
 2870 PRINTTAB(20,i+1);CHR$nothing;" ***";TAB(II,i
+1);CHR$nothing;test$
 2880 Z=INKEY(10)
 2890 NEXT
 2900 PRINTTAB(II,i+1);CHR$white;test$
 2910 PROCpause
 2920 ENDPROC
 2930
 2940 DEFPROCcolour_tree
 2950 PROCsection(1,1,magenta)
 2960 PROCsection(2,3,red)
 2970 PROCsection(4,7,yellow)
 2980 PROCsection(8,15,blue)
```

See 'See How They Sort', page 117

Program 2. Sort procedures unadorned

```
>LIST
   10 DEFPROCswap(i,j)
   20 sorted=FALSE
   30 spare$=dest$(i)
   40 dest$(i)=dest$(j)
   50 dest$(j)=spare$
   60 ENDPROC
   70
   80 DEFPROCbubble
   90 FOR I=1 TO max-1
  100 sorted=TRUE
  110 FOR J=max TO I+1 STEP -1
  120 IF dest$(J-1)>dest$(J) THEN PROCsw
ap(J,J-1)
  130 NEXT
  140 IF sorted THEN I=max-1
  150 NEXT
  160 ENDPROC
  170
  180 DEFPROCshuttle
  190 I=0
  200 top=0:bottom=max:inc=1
  210 REPEAT
  220 sorted=TRUE
  230 REPEAT
  240 I=I+inc
  250 IF dest$(I)>dest$(I+1) THEN PROCsw
ap(I,I+1)
  260 UNTIL I+inc=top OR I+inc=bottom
  270 IF I+inc=top THEN top=top+1:inc=1
  280 IF I+inc=bottom THEN bottom=bottom
-1:inc=-1
  290 UNTIL bottom<=top+1 OR sorted
  300 ENDPROC
  310
  320 DEFPROCinsertion
  330 FOR I=2 TO max
  340 FOR J=I TO 2 STEP -1
  350 IF dest$(J-1)>dest$(J) THEN PROCsw
ap(J,J-1) ELSE J=2
  360 NEXT
  370 NEXT
  380 ENDPROC
  390
  400 DEFPROCselection
  410 FOR I=1 TO max-1
  420 lowindex=I
  430 FOR J=I+1 TO max
  440 IF dest$(J)<dest$(lowindex) THEN l
owindex=J
  450 NEXT
  460 IF lowindex<>I THEN PROCswap(I,low
index)
  470 NEXT
  480 ENDPROC
  490
  500 DEFPROCshell
  510 inc=max DIV 2
  520 REPEAT
  530 IF inc<=0 THEN 580
  540 FOR I=inc+1 TO max
  550 PROCpair(I,I-inc)
  560 NEXT
  570 inc=inc DIV 2
  580 UNTIL inc<=0
  590 ENDPROC
  600
  610 DEFPROCpair(i,j)
  620 IF j<=0 THEN ENDPROC
  630 IF dest$(i)<dest$(j) THEN PROCswap
(i,j):PROCpair(j,j-inc)
  640 ENDPROC
  650
  660 DEFPROCquick(i,j)
  670 LOCAL pivotindex,partitionpoint,I
  680 pivotindex=FNfindpivot(i,j)
  690 IF pivotindex=0 THEN ENDPROC
  700 partitionpoint=FNpartition(i,j,piv
otindex)
  710 PROCquick(i,partitionpoint-1)
  720 PROCquick(partitionpoint,j)
  730 ENDPROC
  740
  750 DEFFNfindpivot(i,j)
  760 LOCAL I
  770 I=i
  780 IF I=j THEN =0
  790 IF dest$(I)>dest$(I+1) THEN =I
  800 IF I+1=j THEN =0
  810 IF dest$(I)<dest$(I+1) THEN =I+1
  820 I=I+1:GOTO 780
  830
  840 DEFFNpartition(i,j,K)
  850 pivot$=dest$(K)
  860 L=i:R=j
  870 REPEAT
  880 PROCswap(L,R)
  890 IF dest$(L)<pivot$ THEN L=L+1:GOTO
 890
  900 IF L=R THEN 920
  910 IF dest$(R)>=pivot$ THEN R=R-1:IF
R>L THEN 910
  920 UNTIL L>=R
  930 =L
  940
  950 DEFPROCtree
  960 FOR I=2 TO max
  970 PROCbackup(I)
  980 NEXT
  990 FOR I=max TO 2 STEP -1
 1000 test$=dest$(I)
 1010 dest$(I)=""
 1020 PROCswap(1,I)
 1030 PROCputback(1)
 1040 NEXT
 1050 ENDPROC
 1060
 1070 DEFPROCbackup(J)
 1080 REPEAT
 1090 IF dest$(J)>dest$(J DIV 2) THEN PR
OCswap(J,J DIV 2)
 1100 J=J DIV 2
 1110 UNTIL J=1
 1120 ENDPROC
 1130
 1140 DEFPROCputback(J)
 1150 LOCAL swapindex
 1160 swapindex=J*2
 1170 IF swapindex>=I THEN dest$(J)=test
$:ENDPROC
 1180 IF dest$(swapindex)<dest$(swapinde
x+1) THEN swapindex=swapindex+1
 1190 IF swapindex>=I THEN dest$(J)=test
$:ENDPROC
 1200 IF test$>=dest$(swapindex) THEN de
st$(J)=test$ ELSE PROCswap(J,swapindex):
PROCputback(swapindex)
 1210 ENDPROC
```

See 'Internal Examination', page 123

Paul Beverley's program for the signature analysis unit

```
  10 CLS
  20 PROCinitialise
  30 REPEAT
  40   PROCmenu
  50   UNTIL X%=0
  60 END
  70
  80 DEF PROCmenu
  90 REM ********
 100
 110 VDU26,12
 120 INPUT TAB(0,2)"Test number? "X%
 130 VDU28,0,24,30,5
 140 IF X%=0 ENDPROC
 150 N%=32
 160
 170 REPEAT
 180   IF N%=13 OR N%=-1 N%=INKEY(5)
 190   IF N%=32 PROCprompt
 200   IF N%>32 UNTIL TRUE:ENDPROC
 210 *FX19
 220 CALL test
 230 PROCprint
 240 UNTIL N%>32
 250 ENDPROC
 260
 270 DEF PROCprompt
 280 REM **********
 290
 300 PRINT
 310 N%=GET
 320 IF N%=13 ENDPROC
 330 IF N%=47 ENDPROC
 340
 350 REPEAT
 360   PRINT CHR$(N%);
 370   N%=GET
 380   UNTIL N%=13
 390 N%=32
 400 ENDPROC
 410
 420 DEF PROCprint
 430 REM *********
 440
 450 @%=1
 460 PRINT TAB(8)~(A% AND &F000)
     DIV &1000;
 470 PRINT~(A% AND &F00) DIV &100;
 480 PRINT~(A% AND &F0) DIV &10;
 490 PRINT~A% AND &F
 500 ENDPROC
 510
 520 DEF PROCerr_handle
 530 REM **************
 540
 550 VDU26,12
 560 REPORT
 570 PRINT" at "ERL
 580 ENDPROC
 590
 600 DEF PROCinitialise
 610 REM **************
 620
 630 ON ERROR PROCerr_handle:END
 640 ?&FE6B=8 : REM S.R. to input
 650 ?&FE62=&81 : REM PB0 & PB7 as output
 660
 670 FOR opt% = 0 TO 2 STEP 2
 680   P% = &C00
 690   [OPT opt%
 700
 710   .test
 720   \****
 730
 740   SEI
 750   LDY #0
 760   LDA #&80
 770   STA &FE60
 780   LDA #&81
 790   STA &FE60
 800
 810   JSR testX%
 820
 830   .read_SR
 840   \*******
 850
 860   LDX #&01     \ Disable clock input.
 870   STX &FE60    \ i.e. enable CB1 clock.
 880
 890   LDX &FE6A    \ Dummy read of S_R.
 900
 910   LDA #&04     \ To check S_R flag.
 920
 930   .ready%
 940   BIT &FE6D    \ Has new value
 950   BEQ ready%   \ shifted in yet?
 960
 970   LDX &FE6A    \ Read shift register.
 980   STX &405
 990
1000   .again%
1010   BIT &FE6D    \ Has new value
1020   BEQ again%   \ shifted in yet?
1030
1040   LDX &FE6A    \ Read shift register.
1050   STX &404
1060
1070   LDX #&81
1080   STX &FE60
1090
1100   CLI          \ You can interrupt now!
```

Continued ►

◀ Continued

```
1110    RTS
1120
1130    .testX%
1140    \******
1150
1160    CPX #2
1170    BCS test2%
1180
1190    .test1%
1200    \******
1210
1220    STA &8AAA,Y \ Low ROM
1230    DEY
1240    BNE test1%
1250    RTS
1260
1270    .test2%
1280    \******
1290
1300    CPX #3
1310    BCS test3%
1320
1330    .next2%
1340    LDA &CFA5,Y \ High ROM
1350    DEY
1360    BNE next2%
1370    RTS
1380
1390    .test3%
1400    \******
1410
1420    CPX #4
1430    BCS test4%
1440
1450    .next3%
1460    LDA &C00,Y   \ Low RAM
1470    DEY
1480    BNE next3%
1490    RTS
1500
1510    .test4%
1520    \******
1530
1540    CPX #5
1550    BCS test5%
1560
1570    .next4%
1580    STA &7800,Y \ High RAM
1590    DEY
1600    BNE next4%
1610    RTS
1620
1630    .test5%
1640    \******
1650
1660    CPX #6
1670    BCS test6%
1680
1690    .next6%
1700    LDA &FE40    \ Internal VIA
1710    LDA &FE41
1720    DEY
1730    BNE next6%
1740    RTS
1750
1760    .test6%
1770    \******
1780
1790    CPX #7
1800    BCS test7%
1810
1820    .next7%
1830    LDA &FE80    \ Disc Controller
1840    LDA &FE81
1850    LDA &FE82
1860    LDA &FE84
1870    DEY
1880    BNE next7%
1890    RTS
1900
1910    .test7%
1920    \******
1930
1940    CPX #8
1950    BCS test8%
1960
1970    .next7%
1980    LDA &FE20    \ Video ULA
1990    LDA &FE21
2000    DEY
2010    BNE next7%
2020    RTS
2030
2040    .test8%
2050    \******
2060
2070    LDA &FE08    \ ACIA
2080    LDA &FE09
2090    DEY
2100    BNE test8%
2110    RTS
2120
2130    ]
2140    NEXT
2150 ENDPROC
```

See 'Atomic Text', page 143

Alex Wilson's 'Wordprint' wordprocessing program for the Atom with Star Gemini X10 printer connected

```
 10 G.z
 19 REM SAVE
 20sF.I=0 TO9;I?#2984=32;N.;IN."FILENAME"$D;L=LEND
 22 I=0;DO;I?#2984=I?D;I=I+1;U.(I=L ORI=9)
 24 ?#8202=?#80;?#8203=?#81
 26 *SAVE"1234567890"8200 8202 8200
 27 S=#8202;T=!#80;F=FOUT"";WAIT;BPUTF,#AA;WAIT;PUTF,T;F.N=S TOT
 28   BPUTF,?N;N.
 30 R.
 39 REM LOAD
 401P."LOAD DATA TAPE PRESS CTRL WHEN  NAME SHOWS"'
 41 *CAT
 44 S=#8202;F=FIN"";DO;U.BGETF=#AA;F.N=S TO(GETF);?N=BGETF;N.
 46 ?#80=?#8202;?#81=?#8203
 50 R.
 52bQ=0;IN."O.K."$D;IF?D=78;Q=1
 53 R.
 55 REM WRITE TEXT
 56aS=#8204;P.$12"TEXT"'
 58dIN.$B;GOS.b;K=LENB;IF?B=90;IFB?1=90;G.62
 59 IFQ=0;I=0;DO;S?I=B?I;I=I+1;U.I=K;S=S+K;?S=13
 60 IFS>#9700;IN."TEXT SPACE FULL"$D;G.62
 61 G.d
 62 R.
 71 P.$17;P.$3;G.y
 72  999 aNYSTREET,*aNYTOWN,*aNYCOUNTY,*aNYCODE*01 999 9999*
 73 REM REMOVE ALLSPACES AND REMS UP TO LINE 71
 80cI=0;DO;B?I=S?I;I=I+1;U.I=29
 82 B?29=13;P." "$B';L=LENB;S=S+L;J=J+1
 86 IFS>=!#80;E=0
 88 R.
 89 REM INSERT CONTROLS
 91 B?X=52;R.
 92 B?X=45;X=X+1;B?X=1;R.
 93 B?X=53;R.
 94 B?X=87;X=X+1;B?X=1;Y=2;?#86=1;R.
123 B?X=83;X=X+1;B?X=0;R.
124 B?X=45;X=X+1;B?X=0;R.
125 B?X=83;X=X+1;B?X=1;R.
126 B?X=84;R.
127eS=#8204;U=S;REM EDIT
128nJ=0;T=S;P.$12"          1         2"'
129 P."  01234567890123456789012345678"';E=1
130 @=0;P.J;GOS.c;U=T
131 IFE=1;IFJ>9;G.133
132 IFE=1;G.130
133 IN."A,B,D,I,N,Z"$D;F=?D;IFF=90;R.
134 IFF<65 ORF>90;P.$11;G.133
135 IFF<>66;G.138
136 IFU>#8204;U=U-290;S=U;T=U;G.n;REM BACK
137 P."CAN'T GO BACK"'$11$11;G.133
138 IFF<>78;G.m
140 IFE=0;P."END OF TEXT  "'$11$11;G.133
141 U=T;G.n
142mIN."WHICH LINE"$D;C=VALD;IFC<0 ORC>9;P.$11;G.m
144oIN."WHICH COLUMN"$D;A=VALD;IFA<0 ORA>28;P.$11;G.o
146 S=T+29*C+A;R=!#80
148 IFF=68;G.160
149 P."TEXT";REM INSERT,AMEND
150 IN.$B;L=LENB;GOS.b;IFQ=1;G.150
151 IFF=65;G.154
```

Continued ►

◀ Continued

```
152 V=R+L;!#80=V;DO;?V=?R;V=V-1;R=R-1;U.R=S-1
154 I=0;DO;S?I=B?I;I=I+1;U.I=L;S=T;G.n
160 IN."DELETE HOW MANY"$D;G=VALD;IFG<0;P.$11$11;G.160
162 DO;?S=S?G;S=S+1;U.(S+G)=R;?S=13;!#80=S
164 S=T;G.n
189 REM SINGLE/DOUBLE STRIKE, EMPHASISED
190u?#8D=0;?#92=0;P."OUTPUT TO PRINTER"'"1 SINGLE"'
192 IN."2 DBLE.STRIKE"'"3 EMPHASISED"$D;R=VALD;IFR<1 ORR>3;Q=1
194 IFR=2;?#8D=1
195 IFR=3;?#92=1
196 R.
199 REM PRINT STYLE
200p?#85=0;?#88=0;?#8B=1;Q=0;GOS.u;IFQ;G.p
210 IN."1 10CPI"'"2 12 CPI"'"3 17CPI"$D;P=VALD;IFP<1 ORP>3;G.210
212 ?#90=P;IFP=1;?#87=80;G.r
214 IFP=2;?#87=96;G.r
216 ?#87=136
230rIN."LEFT HAND MARGIN"$D;M=VALD;IFM<0 ORM>20;G.r
232 IFM=10;M=9
240 ?#8A=M;P."DEFAULT IS 60 LINES"'
242 IN."MAX.NO.OF LINES PER PAGE"$D;L=VALD;IFL=0;L=60
244 ?#89=L
250 P."MAX.NO.OF LETTERS PER LINE IS"'?#87-2*M'
252 IN."NO.OF LETTERS PER LINE"$D;C=VALD;IFC=0;C=?#87-2*M
254 IN."DOUBLE SPACED Y/N"$D;IF?D=89;?#8B=2
260 ?#8C=C;IN."DATE REQUIRED Y/N"$D;IF?D=89;?#88=1
270 IN."DO YOU WANT ADDRESSED HEADING Y/N"$D;IF?D=78;R.
272 IF?D=13;G.270
280 ?#85=C-M;GOS.f;R.
299 REM PRINT TEXT
300qL=?#89;M=?#8A;K=?#8B;C=?#8C
302 IN."SET UP PAPER"'"PRESS RETURN TO START"$D;IF?D<>13;G.q
310 P.$2;GOS.x;U=0
314 IF?#85=0;G.321
316 Z=9;P.$9;U=0;S=#2B63;GOS.g;U=U+4*K
321 IF?#88=0;G.330
322 S=#97E0;GOS.v
330 Z=0;IF?#85=0;G.h
332 S=#28A0;GOS.g;P.''';U=U+3*K
350hS=#8204;T=?#80+?#81*256;C=C+1
360jIFU<L;G.k
364 P.$19$3;IN."END OF PAGE"'"ADJUST PAPER"$D;U=0
366 P.$2$17
370kIFS>=T;G.400
380 GOS.v;S=S+V+2
390 G.j
400 P.$19$3$12;IN."ANY MORE COPIES WANTED Y/N"$D
410 IF?D=78;R.
420 GOS.u;G.q
430 GOS.f
434 IN."INSERT ENVELOPE, PRESS RETURN"$D;?#93=M;?#92=1;K=1;M=20
436 P.$2;GOS.x;S=#28A0;C=20;GOS.g;M=?#93;P.$27$70$19$3;R.
449 REM OUTPUT STRING
450vV=0;X=0;Y=1;W=0;IF?#86=1;Y=2
452 DO;E=S?V;IFE<64;G.w
```

```
453   IFE>64;IFE<91;E=E:#20;G.w
454   IFE>96;IFE<123;E=E:#20;G.w
456   IFE>90;IFE<95;B?X=27;X=X+1;GOS.E;G.i
457   IFE>120;IFE<127;B?X=27;X=X+1;GOS.E;G.i
458   IFE=96;B?X=27;X=X+1;B?X=87;X=X+1;B?X=0;Y=1;?#86=0;G.i
460w  B?X=E;W=W+Y
461i  V=V+1;X=X+1
462 U.(W>=C OR E=42 OR E=13)
463 IFE=42;X=X-1;V=V-1
464 IFW>=C;DO;V=V-1;U.V?S=32;DO;X=X-1;U.B?X=32
465 B?X=13;IFZ>0;P.$9
466 F=B;DO;A=?F;LINK#FF10;F=F+1;U.A=13
467 U=U+K;IFK>1;P.'
468 V=V-1;R.
469 REM SET UP PRINTER
470xP.$17$27$64;IF?#85>0;T=?#85;P.$27$68$(T)$0
472 IF?#8D=1;P.$27$71;REM DBLE. STRIKE
474 P.$27$77$(M);IF?#92=1;P.$27$69;?#90=1;REM MARGIN, EMPHASISED
476 F.I=#8E TO#91;A=?I;LINK#FF10;N.
478 P.'$27$55$0$27$61;R.;REM USA, MSB=0
479 REM ENVELOPE
480fIN."NEW ADDRESS Y/N"$D;IF?D=78;R.
482 S=#28A0;P."TYPE NAME AND ADDRESS"';GOS.d;S=S+1
484 ?S=13;R.
490gGOS.v;S=S+V;IF?S=13;R.
492 S=S+2;G.g
499 REM START
500zD=#2800;S=#8204;!#80=S;?#8200=13;?#8201=-1;B=#2810
505 ?16=#51;?17=#2B;P=100;!#8E=#1421B
510 F=#97E0;IN."DATE"$F
520yP.$12"1 WRITE TEXT"'"2 EDIT TEXT"'"3 PRINT TEXT"'
522 P."4 SAVE TEXT"'"5 LOAD TEXT"'"6 REVIEW TEXT"'
523 P."7 ENVELOPE"'"8 END"'
524 IN.$D;C=VALD;IFC<1 ORC>8;G.y
526 G.(530+20*C)
550 IN."1 NEW TEXT"'"2 ADDITIONAL TEXT"$D;C=VALD
552 IFC<1 ORC>2;G.550
554 G.(556+C)
557 GOS.a;!#80=S;G.y
558 S=!#80;GOS.d;!#80=S;G.y
570 GOS.e;G.y
590 IFP=100;GOS.p
592 IN."CHANGE PRINT STYLE Y/N"$D;IF?D=89;GOS.p
594 GOS.q;G.y;
610 GOS.s;G.y
630 GOS.l;G.y
650 S=#8204;E=1
651 J=0;P.$12
652 GOS.c;IFE=1;IFJ>9;GOS.680;IFE=1;G.651
656 IFE=1;G.652
660 GOS.680
664 G.y
670 GOS.430;G.y
680 IN.$D;IF?D=90;E=0;R.
682 IF?D=69;U=S;GOS.n
684 R.
690 E.
```

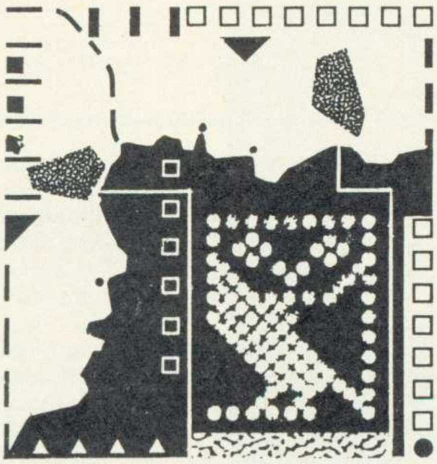
See 'Toolkits on Trial', page 157

Listing 1. Utility in Basic to list the values assigned to all the resident integer variables in decimal and hexadecimal

```
   10 REM **  INTEGER DUMP  **
   20 REM ** (c) Acorn User **
   30 FOR loop=&404 TO &468
   40 !loop=RND
   50 NEXT
   60 PROCvar_dump
   70 END
   80 :
  500 DEF PROCvar_dump
  510 CLS
  520 PRINTCHR$(131);SPC(5);"Integer Var
iable Dump"
  530 PRINT'"Var          Hex          Deci
mal"
  540 VDU 28,0,24,39,3
  550 ascii=ASC"A"
  560 FOR loop=&404 TO &468 STEP4
  570 PRINTCHR$(ascii);"%  ";
  580 PRINT~!loop;"    ";
  590 PRINT!loop
  600 ascii=ascii+1
  610 NEXT
  620 VDU 26
  630 ENDPROC
```

Listing 2. Program compactor utility in machine code

```
  10 REM *** SPACE REMOVER ***
  20 before=&70
  30 after=&72
  40 count=&74
  50 FOR pass=0 TO 3 STEP3
  60 P%=&900
  70 [OPT pass
  80 LDA #0
  90 STA after
 100 STA before
 110 STA count
 120 STA count+1
 130 LDA &18
 140 STA after+1
 150 STA before+1
 160 .outer
 170 LDY #1
 180 JSR transfer
 190 CMP #&FF
 200 BEQ all_done
 210 JSR transfer
 220 JSR transfer
 230 .inner
 240 LDA (before),Y
 250 CMP #ASC" "
 260 BEQ space
 270 JSR transfer
 280 BEQ end_of_line
 290 CMP #&22
 300 BEQ inside_quote
 310 BNE inner
 320 .space
 330 INC before
 340 BNE update
 350 INC before+1
 360 .update
 370 INC count
 380 BNE inner
 390 INC count+1
 400 BNE inner
 410 .end_of_line
 420 DEY
 430 TYA
 440 PHA
 450 CPY #3
 460 BEQ clear
 470 LDY #3
 480 STA (after),Y
 490 CLC
 500 ADC after
 510 STA after
 520 BCC clear
 530 INC after+1
 540 .clear
 550 PLA
 560 CLC
 570 ADC before
 580 STA before
 590 BCC outer
 600 INC before+1
 610 BNE outer
 620 .inside_quote
 630 JSR transfer
 640 BEQ end_of_line
 650 CMP #&22
 660 BNE inside_quote
 670 BEQ inner
 680 .transfer
 690 LDA (before),Y
 700 STA (after),Y
 710 INY
 720 CMP #13
 730 RTS
 740 .all_done
 750 LDA after
 760 CLC
 770 ADC #2
 780 STA &12
 790 LDA after+1
 800 ADC #0
 810 STA &13
 820 LDA #ASC"&"
 830 JSR &FFEE
 840 LDA count+1
 850 BEQ zero
 860 JSR hexout
 870 .zero
 880 LDA count
 890 JSR hexout
 900 BRK
 910 EQUW &0B0B
 920 EQUD &09090909
 930 EQUS" spaces removed"
 940 EQUB 13
 950 BRK
 960 RTS
 970 .hexout
 980 PHA
 990 LSR A: LSR A
1000 LSR A: LSR A
1010 JSR digit
1020 PLA
1030 .digit
1040 AND #15
1050 CMP#10
1060 BCC over
1070 ADC #6
1080 .over
1090 ADC #48
1100 JMP &FFEE
1110 ]:NEXT
```



Update on the NFS chip, better security for data files, testing the RS423 port, finding the file length – presented by Bruce Smith

The NFS chip: more differences

SINCE writing the DNFS review (Beeb Forum, August), Robin Newman brings to our attention two further unpublished differences from the existing DFS and NFS chips. He writes . . .

The first concerns the use of the *DESTROY and *BACKUP commands. When using DFS 0.9 these have to be preceded immediately with a *ENABLE command, due to their potentially drastic effects. With DNFS this *ENABLE can be omitted, in which case the promp 'GO (Y/N) ?' follows the issuing of the command. A 'Y' sends it on its merry way, and any other key aborts the command. This is particularly useful with the *BACKUP command because the information 'copying from :0 to :2' (or whatever the relevant drives are) is printed before the prompt 'GO (Y/N) ?' is issued. This gives a chance for the command to be aborted if the source and destination drives have been typed in the wrong order.

The second difference concerns the NFS half of the chip. Recently I have written a Network version of the '*BUILD fname' command contained in the DFS chip. This is useful for forming !BOOT files etc for use on the network. To extract the filename 'fname' from the end of the command line, I have used OSARGS with A=1 (see my example in Beeb Forum, May 1984, listing 1). The 'old' NFS 3.34 incorrectly returns the address of the START of the command line, ie the byte containing the B of BUILD in this case. NFS360 (contained in DNFS) correctly returns the address of the f of fname.

The problem is that one has to accommodate both protocols. Listing 1 shows how I have done this. It is not very elegant, requiring a direct peek at the NFS ROM to determine which version it is. Does anybody know a call that returns the NFS version running in the local machine?

I hope this information will be of use to DNFS users, and that the second one will prevent others wasting time finding a bug not of their own making. It is good that Acorn has made the new NFS and DFS versions compatible as far as this OSARGS call is concerned. It would have been even better had they let everyone know about it!

```
10 REM excerpt from Net *BUILD command utility by R.Newman
20 osargs=&FFDA:pb%=&70
.
.
.
80 .start LDA#1:LDY#0:LDX#pb%:JSR osargs \ get command line pointer
90 LDA &8004:CMP#&AF:BNE not334 \ check if NFS3.34
100 LDY#0 \ NFS3.34 so search for first space after BUILD
110 .nextchar LDA(pb%),Y:CMP#13:BEQ error \ error if end of line found
120 CMP#32:BEQ nextchar2 \ branch if space found
130 INC pb%:BNE nextchar \ increment pointer and force branch back
140 .nextchar2 LDA(pb%),Y:CMP#32:BNE not334 \ now search for first
non-space character; branch if found
150 INC pb%:BNE nextchar2 \ increment pointer and force branch back
160 .not334 \ rest of program follows. pb% now points to f of fname
.
.
.
```

Listing 1. Code showing how both protocols can be accommodated when it is entered at start by typing *BUILD fname

£5 Confuse the illicit copier

ELLIS THOMAS's ideas on cursor editing from within a running program (Beeb Forum, August) stimulated some thought. Adrian Robson of Hexham, Northumberland, writes . . .

The method described could be very useful for some applications but, in the case of file copying, it has a major failing in that it does not obtain the true file name. Let me explain . . .

A method of providing your programs and data files with greater security is to use non-alphanumeric ASCII codes in the file name. For example 240, which is 'p' in mode 7. To do this you must use an OSFILE call to create the file. Anyone subsequently using LOAD or *LOAD on the file will find that the file name prints on the screen with '?' for the non-alphanumeric ASCII codes. They will be unable to save the file using SAVE or *SAVE, with the correct file name. Even if they knew the file name, they would be unable to enter it directly from the keyboard.

In operation two methods are available for providing the required security: the program could be executed by using CHAIN"", thus avoiding the non-ASCII characters in the file name. The program checks that bytes &3B2-&3BD contain the expected file name and refuses to run correctly if it does not. OSBYTE &A0 can, of course, be used to access the name.

The second method, applicable to data and machine code files, is to load the file via an OSFILE call using the correct name in the control block. However, the former method is recommended as it causes greater confusion to the illicit copier.

This technique can also, of course,

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be used for data or machine code files.

Now we obviously require a method of taking legitimate back-ups of our protected files and it is equally obvious that the cursor editing method will not work in this case. The only method available involves access to page three and using an OSFILE call to save the file. This has the additional advantage of simplicity compared with the cursor editing method.

The comment that cursor editing will minimise problems with new OS releases is valid. However, it is more likely that the screen format of the *OPT 1,2 load message will change on future releases rather than the internal header block format or location. Anyway, the risk and consequences of either is so minimal that they can be only a minor consideration when deciding on the best method for arranging for automatic file backup for your own programs and data.

In conclusion, the cursor editing method is a sophisticated means of arranging file copying, but sophistication is not an end in itself, no matter how well it is justified. To coin a phrase, the cursor editing method when applied to file copying is equivalent to using a hammer to crack a nut and then missing the nut!

£10 423 . . . testing the serial port

ONE aspect of the Beeb not often touched on is the RS423 serial port. Perhaps this is because the pin-out diagram in the *User Guide* is incorrect, as John Gallagher of Carlow, Ireland, points out . . .

The diagram of the five-way DIN plug on page 406 of the *User Guide* is incorrect in that the indentation representing the plug case earth should be at the top of the diagram. The connections are otherwise correct . . .

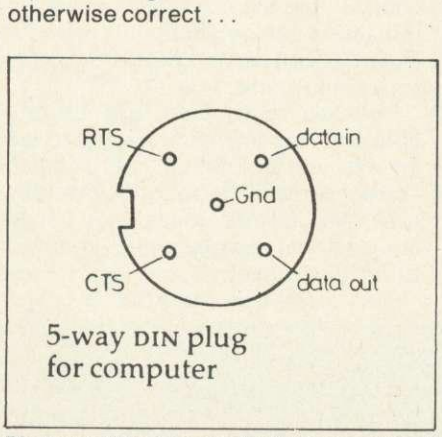


Diagram of the five-way DIN plug as printed in the User Guide. The indentation should be at the top

Alan Crabb's disc catalogue reader program is printed on yellow page 103

John also offers testing techniques . . .

A simple test of the operation of the RS423 output is the following. Connect pins A and B together and pins D and E together (Data out to Data in and CTS to RTS). Type in the following series of commands.

*FX7,1 <CR>
*FX8,1 <CR>
*FX3,5 <CR>
*FX2,1 <CR>

Now press any letter on the keyboard and if the serial port is operating properly the screen will print 'Syntax Error' continuously at a slow rate. The screen will also display multiple prompts. If the DIN plug is removed the screen display will halt. The test is crude but effective . . .

Finally, John provides serial connections for an Epson printer . . .

a) Connect data out line to pin 3 of the printer.
b) Connect data in line to pin 2 of the printer.
c) Connect ground to pin 7 of the printer.
d) Connect RTS to CTS.

The printer will now print in the serial mode in response to the printer-type command *FX5,2 and the switch-on command Control B or VDU2. Note that the baud transmission and reception rates may require setting using *FX8,n and *FX7,n if the default values do not match.

£10 Get the measure of your files

ALAN CRABB of Shaftesbury took up the challenge to write a program that will read a disc's catalogue and return the length of each file on it (Beeb Forum, August). Alan wins the promised £10 note. Let him explain . . .

The program (listing 2) as it stands will print all the files and their load/exec/length values on the disc in drive 0. The program is completely Tube compatible and uses only 'legal' methods (routines can be written legally, not accessing the DFS catalogue directly).

The listing is fairly well documented but a few extra notes might help.

The OSWORD call with A = &7D returns the disc's 'cycle number' (the number of times the disc contents have been altered). X and Y point to a single byte which contains the drive number and returns the cycle number.

The checks in line 370 for illegal directories test for '"' and ':'. The Acorn DFS seems to interpret the '"' in a funny way and the colon is used for drive selection.

The OSGBPB (get block, put block) may be new to most readers. It is documented on page 339-42 of the *Advanced User Guide* (I do not have an Acorn DFS manual – anyone got one for sale?). The call with A = 8 is used to 'read file names from the current directory' – hence the loop through all normal directories at line 340. The parameter block pointed to by XY is set up as follows:

- 0 Cycle number
- 1–4 Pointer to block for return of names
- 5–8 No. of files to be read decremented by DFS
- 9–C Initially 0, incremented in eights by DFS

The data is returned in the format:

length of filename1
filename 1
length of filename2
filename2 . . .

The length is always 7 and filenames end in spaces if they are shorter.

Finally, lines 800-860 print all the information using functions returning the load, exec and length of each file. The functions may be extracted but be sure to define some workspace for them.

£5 Neat toggling

READERS may be interested to see the assembler routine in the Beeb Forum suggestion for August, 'Printer on, printer off', page 65, reduced from 67 to 14 bytes, writes Robin Tracy of Sutton, Surrey.

```
10 REM Printer Toggler - Utility
20 P% = &A00
30 [ OPT 0
40 LDA #126   : JSR &FFF4
50 LDA &70    : EOR #1     : STA &70
60 JMP &FFEE  : ]
70 ?&220=&0   : REM Interrupt Address
80 ?&221=&A
90 ?&70=3     : REM Printer Off
100 *FX14 6   : REM Enable ESC event
```

In general, Exclusive OR (EOR) does not seem to be as widely applied as it might be. EOR can be used to toggle between any two integer values. There is usually a saving in space too.

Suppose you wish to toggle between 'n' (ASCII 110) and 'y' (ASCII 121) then Exclusive OR does it neatly.

```
105 X = 110
110 REPEAT
120 X = X EOR 23  : REM Will toggle
    X between 121 and 110
130 VDU X
140 UNTIL FALSE
```

To discover '23' enter the line

P. 121 EOR 110.

SEE HOW THEY SORT

A colourful demo by George Hill shows how data is put in order

ONE OF the most frequently performed tasks in computing is sorting, but there are many different methods, as the accompanying programs illustrate. This article will assess their advantages and disadvantages, and compare their performance in various situations.

What items are to be sorted? The example programs use lists of boys and girls names, stored in an array. The sorting algorithms, however, can be applied to virtually any data which can be put in order – integers, floating-point numbers, strings, records with a key, for example.

Two words there need explaining. First, what is an algorithm? It is difficult to define precisely, but if you describe your method for doing something without recourse to any specific computer language, then you have probably stated the alogrithm.

Second, what is a record? It is a collection of pieces of information, all of which 'belong' to a single item – for example, a person's name, address, telephone number, age, sex, etc. Basic does not recognise records, but they are a fundamental concept in languages that deal conveniently with data processing. Most important sorting methods must be able to deal with records, and some must be able to sort records from disc or tape files.

There are two programs. Program 1 allows the various sorts to be operated by selection from a menu. Sixteen assorted names will be sorted slowly, with colour coding to help you follow the sorting process as it occurs. Program 2 consists of the sorting procedures only. They are shorn of all the frills of program 1 that allow the sorts to be watched in action. It serves two purposes: first, to allow you to see how the sorting algorithms are translated into Basic; second, to allow you to copy and adapt them for your own use, should you need to sort some data in a program of your own.

Bubble sort

The first and most commonly understood and used sort is the 'bubble' sort. There are many variations of it, but the simplest and most obviously 'bubbling' algorithm is as follows:

The starting list has n items.
Compare the bottom two items (n and n–1).
If the lower one is smaller, swap them, otherwise do nothing.
Now compare the next two items (n–1 and n–2).
Swap, or don't swap as before, so that the smaller item ends up higher.
Repeat the process until the smallest item in the list reaches the top.
Now start at the bottom again, and repeat the swapping procedure until the next smallest item is in position 2.
Go on until the list is in order.

The procedures required for this are PROCbubble and PROCswap(i,j). PROCswap simply swaps the array items dest$(i) and dest$(j), and sets the flag 'sorted' to FALSE. This latter is a simple way of avoiding retesting already sorted items. If no swaps take place in any pass up the list, then the items must already be in order, so we should exit from the procedure.

Program 1 uses a number of conventions. Items being compared are indicated in green. When they are swapped they are shown in cyan (pale blue). When the program is run and 'bubble' is selected you will see the source list of names on the left and the destination list on the right. The items will be bubbled up from the bottom and will reach their appointed places as described above.

There are pauses generated by INKEY(waittime). These stop the program running so fast that you cannot follow it. If you still find it too fast, 'waittime' is set in PROCsetup. Increase it to 200 for a two-second pause, 300 for three seconds, and so on. If you want to 'single-step' the program, set it to 100,000 (or higher), then you will get the next step on hitting any key.

This seems an appropriate moment for a quick skim through program 1.

The main program is very simple. A number of variables and arrays are set up (PROCsetup), and a sorting method chosen from the menu. The sort then takes place, and you are returned to the menu after pressing any key. The last choice terminates the program. Any sort can be aborted by pressing the ESCAPE key, which returns you to the menu.

The sort names ('BUBBLE', etc) and the names to be sorted are in data statements and can be added to simply by adding items to the data statements. The number of sorts is limited to 20, and the last one must be 'END'. The number of items in the arrays is limited to 128 – though this could easily be increased – and the last one must be '***'. If you increase the number of names beyond 18 it will not be possible to use the 'before your very eyes' element of the program. An adaptation of the program, using the sorting procedures of program 2 but no display, was used with various numbers of data items to produce the timings in table 2, of which more anon.

The display is in mode 7 and the teletext colour characters are defined as variables (eg, red = 129) in PROCsetup. This makes the subsequent colouring easier to follow. The total number of items in the array is 'max', while the number of sorts is 'num_of_sorts'. The unsorted array is source$() while dest$() is the array that is sorted by the various procedures.

PROCmenu is straightforward.

FNchoose(M$) is a useful general-purpose function that allows you to pass a string of the form '1 to 20' or '1,2,3,4 or 5' to it, and to select only valid numbers in the stated range. Its limitations are that the left number must be between 0 and 9, and the right number must be between 1 and 999.

PROCdouble produces a heading and sets the text window.

PROCwait clears any residual colours on the destination list, and waits while you check that the sort has worked.

PROClist simply lists the destination array.

PROCsection(i,j,colour) colours a section of the array in the chosen colour.

George Hill's colour-coded sort demo and procedures are listed on pages 104–106

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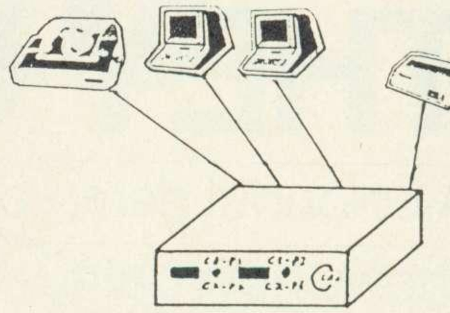
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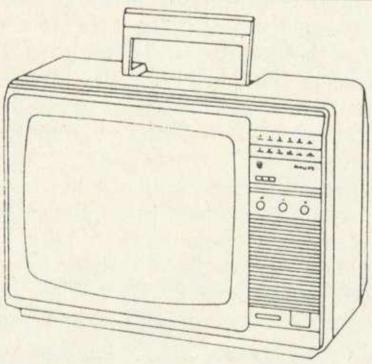
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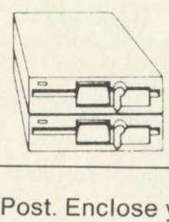
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PROCmark(i,j,colour,pause) marks two items in the chosen colour, and if pause is TRUE (T is TRUE, F is FALSE), a pause is generated by PROCpause for 'waittime' hundredths of a second.

PROCswap(i,j) swaps two items of the destination array, and adjusts the display.

Shuttle sort

The second sort, called 'shuttle', is a variation of the bubble sort. It pushes the biggest item down to the bottom, bubbles the smallest up to the top, then pushes down the next biggest and bubbles up the next smallest. It is attractive in concept but takes the same number of passes as the bubble sort and, due to the cumbersome coding necessary, is much slower.

Insertion sort

The third sort is an 'insertion' sort, whose algorithm is as follows:

Start with the top two items and swap them if necessary to get them in order.
Now take the third item and *insert* it (by bubbling it up) into its correct place among the items already sorted.
Now take the next item, and insert it in its correct place.
Repeat till you get to the bottom item in the list.

Selection sort

The fourth sort is a selection sort. Many sorting algorithms can be adapted to be a selection sort. The principle of selection is as follows:

Do all the comparisons necessary to decide where an item goes *before* actually doing any swapping. Swap only when you know the item's destination.

This has enormous advantages in large-scale sorting operations, where the items to be sorted are complicated records and moving them is time-consuming.

Taking this principle to its extreme, we can often avoid moving the items. We could have a set of 'pointers' to the records and carry out comparisons on the 'key' field – eg the surnames. Instead of moving the records, we move the pointers. We finish with a sorted set of pointers, which in many cases is just as good as a sorted set of records. We can recall them in alphabetical order, for example, and if it is necessary to sort the records themselves, we know where they have to go before we start moving them about – an obvious advantage which lets us minimise the number of moves necessary.

The selection sort here uses the same basic method as the bubble sort. It works as follows:

Start at the top, and 'remember' item one.
Compare it in turn with each of the items below it.
If an item is smaller, then 'remember' it instead.
Go on comparing and 'remembering' until the bottom of the list is reached.
The 'remembered' item is now the smallest.
Swap it with item one (unless it was already there).
Repeat this with item two, three, etc until the items are sorted.

The program marks the position for replacement in red, and the remembered item in yellow. The countdown is followed by a green marker.

The disadvantage of these methods is that items tend to move up the list rather slowly. The bubble sort operates much faster on a partially sorted list than on a random one, and has its 'worst case' when the items are in reverse order. (Every time a comparison is made a swap has to be carried out, and the 'sorted' getout flag never gets set.) If only one item is out of order, then only one pass will be necessary to place it, and the 'sorted' flag is set on the next pass. The Shell sort is a brilliant method of making the items move more rapidly, and cutting down drastically on the time needed.

Shell sort

In the shell sort items are first compared which are separated by half the list.

For an array with 16 members we compare (and swap as necessary) items 1 and 9, 2 and 10 etc.
Return to the top of the list, and halve the comparison interval, ie, compare items 1 and 5, 2 and 6 etc. If an item is swapped, it must be swapped up as far as it will go at this interval. (Thus if we have to swap items 13 and 9, we must compare the new 9 with 5, and then (if swapped) 5 with 1, otherwise an item might get 'stuck' in the bottom half.)
Now compare items 1 and 3, 2 and 4, etc. Items must be 'back compared' if swapped as before.
A single pass down the list will eventually produce the sorted order.

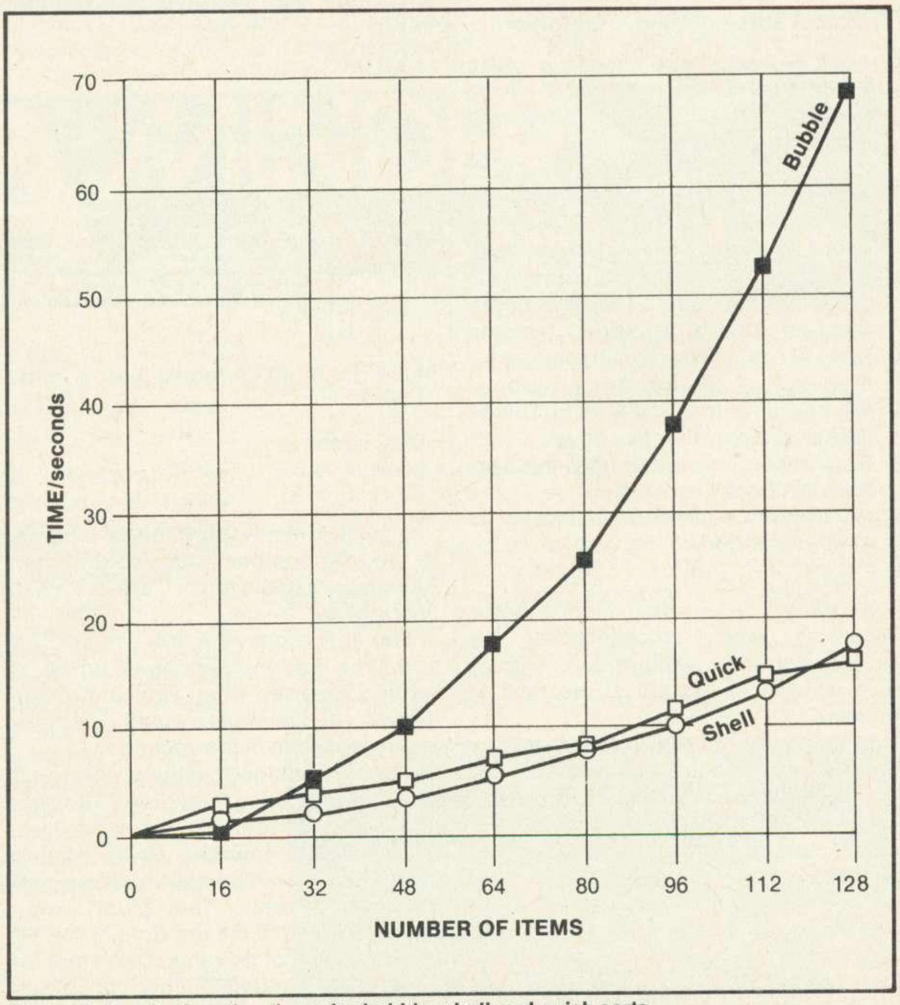


Figure 1. Graph of sorting times for bubble, shell and quick sorts

METHOD OF SORTING	NUMBER OF ITEMS, timed in seconds							
	16	32	48	64	80	96	112	128
Bubble	0.83	4.21	9.83	17.87	26.67	38.23	52.32	69.2
Shuttle	1.08	5.8	12.63	23.36	33.69	47.13	63.69	86.01
Insertion	0.68	3.43	7.92	14.4	20.68	29.44	40.4	53.83
Selection	0.61	2.06	4.31	7.43	11.29	15.91	21.38	27.66
Shell	0.67	2.21	4.0	6.12	8.26	9.88	12.12	16.75
Quick	1.43	3.04	4.96	7.1	8.78	11.73	13.69	15.57
Tree	1.56	3.93	6.91	9.95	13.29	16.91	20.42	24.18

Table 1. Time trial results for each sort

The mathematical reasons for the efficiency of this method are not clearly understood, but it produces remarkably consistent results, and is the method I would recommend if you want to sort medium amounts of data (50 to 500 items, say).

The last two methods in this brief survey are the most difficult to understand, and are valuable if large amounts of data must be sorted (from 200 to many millions of items).

Quick sort

The quick sort algorithm is as follows:

> Look at the list and choose a 'pivot' value. Don't be too fussy, but it will be better if the pivot is somewhere near the middle of the list.
> Now sort the list so that a 'partition' appears, above which all items are smaller than the pivot, and below which all items are less than or equal to the pivot. (It is not implied at this point that the items in either half are in order, nor is it implied that the pivot value is at the partition point.)
> Now look at the top section (above the partition) and find a pivot. Divide it around a partition as above.
> Repeat this sequence until the section partitioned is in order.
> Go on until each sub-section left is similarly sorted.

Horrible, isn't it?

Actually it is an ideal algorithm for recursion, which accounts for my rather awkward explanation. Recursion is hard to explain at the best of times.

Let's look at one bit of quick sort to get the idea. We are trying to sort the numbers 4,2,9,7,1,3. Choose a pivot. I choose 4. (At least it is not the smallest, as the next number (2) is less, so it is somewhere near the middle.)

Let's call the first item 'left', and the last the 'right'. Imagine pointers (L and R respectively) pointing at each. Swap the L and R values. This ensures that there is one item in the bottom half which is less than or equal to the pivot. So the order now is:

```
3,2,9,7,1,4
L         R
```

Move the left pointer along until it hits a value greater than or equal to the pivot (4):

```
3,2,9,7,1,4
    L     R
```

Now move the right pointer until it either coincides with the left, or hits a value less than the pivot (4 – remember?):

```
3,2,9,7,1,4
    L   R
```

Swap the values at L and R:

```
3,2,1,7,9,4
    L   R
```

Move L right until it hits a value >= pivot:

```
3,2,1,7,9,4
      LR
```

Move R left until it meets L, or a value < pivot:

```
3,2,1,7,9,4
      L
      R
```

The section is now partitioned. L points to the first number in the bottom half. All numbers to the left of L are <4, all to the right are >=4.

You now repeat the process on 3,2,1 and 7,9,4 until the section is sorted. A section is sorted when you cannot find a pivot – all values are equal – or there is only one item in the section.

When you follow it using program 1, I recommend a long 'waittime'! The section being partitioned is turned blue. Cyan again marks items being swapped. The left pointer is yellow, and the right green. The pivot value appears in red to the top right of the list to remind you of its value. Don't feel inadequate if you don't follow it first time. I didn't, and I wrote it! Check each time that, at the end of each section, the values above the yellow or green marked value are less than the pivot, and those below are greater or equal.

Tree sort

The final sort is the tree sort or heap sort. The values are treated as a binary tree. This may become clearer if you look at the examples below. The algorithm is as follows:

> Sort the tree out so that the biggest value is at the top (or root – computing trees are upside-down) of the tree, and so that all 'children' are smaller than their 'parents'. This is called a 'partially ordered tree'.
> Now extract the value at the bottom of the tree (its rightmost 'leaf' – upside-down tree, remember).
> Replace it by the 'root', which must have been the biggest value, and so belongs at the bottom.
> Now find the right place to replace the removed leaf by swapping the larger values up towards the root, until the leaf slots in.
> Repeat with the next leaf, and continue until sorted.

Confused? Let's watch it in action for the same six numbers as before, 4,2,9,7,1,3.

As a tree they are:

```
     4
  2     9
 7 1   3
```

Start at the 2, and follow it up to the root 2,4. For the partially ordered tree every parent must be bigger than its children: 4 is bigger than 2, so leave them.

```
     4
  2     9
 7 1   3
```

Move on to 9, and follow it up – 9,4 – 9 is greater. Swap them. Move on to 7 – 7,2,9. Needs changing to 2,7,9, and the tree is now

```
     9
  7     4
 2 1   3
```

Move on to 1 and follow it up – 1,7,9. No change needed.

Move on to 3 and follow it up – 3,4,9. No change needed. Note that 9 is bigger than 7 or 4, 7 is bigger than 2 and 1, 4 is bigger than 3.

To sort the tree, extract the 3, and put the 9 to the bottom:

```
     *
  7     4
 2 1   9
```

Where does the 3 go? Look for the larger child of the empty root. This is the 7. Compare it with the 3. If it is bigger, move it up to the root, and look

at its children:

```
    7
  *    4
 2 1   9
```

Look at the larger child (2). It is smaller than 3, so replace 3 where the * is:

```
    7
  3    4
 2 1   9
```

The subsequent stages in the sort are:

```
    4
  3    1
 2 7   9

    3
  2    1
 4 7   9

    1
  2    3
 4 7   9
```

and the tree is now sorted!

In program 1 the tree's 'generations' are coloured. The root is magenta, first generation is red, second generation yellow, third generation blue, fourth generation (one item only) magenta again. Items being compared are green, and items being swapped are cyan. When an item reaches its correct slot it is white.

Pros and cons

What are the advantages and disadvantages of these methods? Let's ignore the shuttle sort, which seems to have no advantages. The bubble, insertion and selection sorts are all reasonably easy to code, and for small amounts of data there is little to choose between them, though the selection method is clearly faster, as it avoids unnecessary swapping – comparisons are much quicker than swaps.

The shell sort becomes more efficient in the medium range, though it takes a little more careful coding.

The quick sort and tree sort come into their own only on larger amounts of data. Even with 128 items the quick sort has caught up and overtaken the other methods, but the tree sort is still behind shell. On larger amounts quick and tree get well ahead. The great and unreadable authority Knuth suggests that the quick sort should be used to partition down to about nine items, and then the final sort should be done with one of the simpler algorithms. The tree sort has one advantage over the other methods. It always takes the same number of comparisons to carry out the sort whatever order the data was in initially. It has no 'best' and 'worst' case, except for minor variations in the number of swaps necessary, which could be got over by the selection method suggested above. Its disadvantage is that it has to sort the data twice.

Timings of the various methods on varying numbers of random names are summarised in table 1. This clearly illustrates the folly of trying to stick to the simpler algorithms for large numbers of data items, and the equal folly of writing complex recursive procedures to sort small numbers of data items.

Notice how the time taken by the simple algorithms is proportional to n∧2. (If the number of data items double, the time taken is multiplied by 4). The quick sort is an O(nlogn) method, while the tree sort is an O(2nlogn) method. Their times increase much less rapidly as the number of data items increase (for further information I refer you to Stan Froco's article in the February 1984 issue).

One more type of sort needs to be discussed. These are sorts that can be applied to large files. The problems arise when the data cannot all be held in memory at once. Two important sorts which can deal with this situation are the merge sort and the tournament sort, or a combination of the two. These will be illustrated in a later article.

INTERNAL EXAMINATION

The Beeb can be programmed to self-diagnose its own ills. Paul Beverley wields the stethoscope

WHAT do you do if you suspect your computer has a hardware fault? If you have a dealer near at hand and your machine is still under warranty there's no doubt as to the best course of action. But if your machine is out of warranty and if you don't have a good dealer nearby, you have a problem!

Now, assuming you have some idea about electronics – for example, you know one end of a soldering iron from the other and you are bold enough to tinker with your machine – where do you start? The problem is that it's a complex piece of hardware and most of the test techniques available involve expensive pieces of equipment. Suppose you haven't even got an oscilloscope. Is there anything you can do? Well, in this article I hope to show you a technique that is used in industry for fault-finding microprocessor systems.

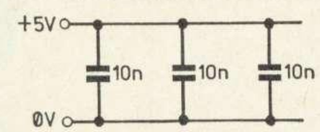
The commercial test units are not cheap, but we can take advantage of the versatility of the BBC microcomputer and use the technique with minimal external hardware that can be made up fairly cheaply on an old bit of Veroboard.

The technique, 'signature analysis', involves actually running a program in the computer under test to check whether the computer is functioning properly. This means that it cannot be used for testing a totally dead machine, but despite this it is a useful technique with the major advantage that it can be done cheaply.

The basic principle

While the test program is running a probe is used to pick up a data stream from one point in the circuit. The hardware compresses this data stream into a 16-bit number, which is read into the computer itself. The number produced by testing any given point (referred to as its 'signature') doesn't have any particular significance in itself, but it will be characteristic of the data stream that produced it. Thus, by comparing it with the expected signature for that point, you can tell whether or not that part of the computer hardware is working properly.

The test routines are tried out on a known working system and the signatures obtained at various test points, such as address and data lines, are noted. These can then be compared with the signatures obtained on a suspect system and, when false signatures appear, it becomes clear that there is a fault. It is important, however, that no interrupts are allowed to occur during the test period as these don't happen at the same time in any given test run and will thus give a different signature each time the test is tried.



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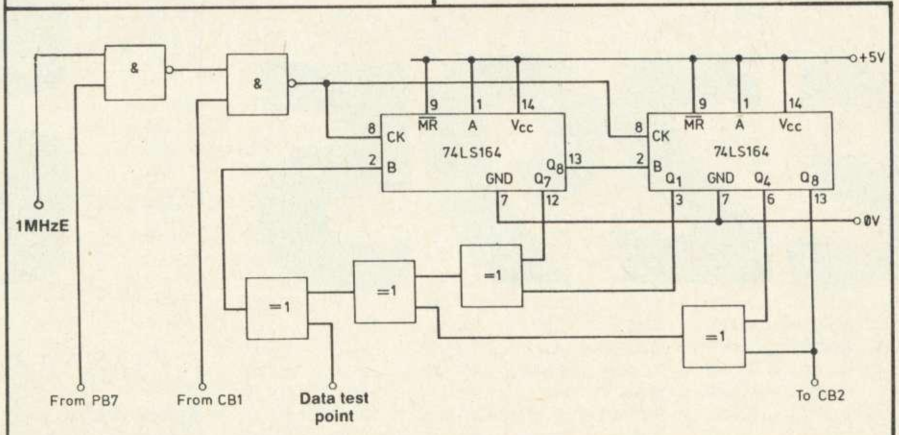


Figure 1. Hardware of the self-test signature analysis system

If the test routine is changed in any way all the signatures will be different, so the routines, once set up, must not be changed. If you want to use the test routines they must be copied faithfully from the listing, then you can use the signature values given in tables 1 and 2. If you want to use different routines, they need to be tried out first on a computer known to be working properly and the signatures recorded. By using different routines you can 'exercise' different parts of the circuit such as the keyboard, display and printer interface.

A number of faults occur commonly in digital systems, and many can be detected by the signature they produce. For example, if a line is permanently low the signature will be 0000, and if the line is permanently high the signature will have a particular value depending on the duration of the test. This value can be found by putting the data probe on the +5v line. If two lines come up with the same, but incorrect, signature the chances are there is a short-circuit somewhere between those two lines.

Hardware

The circuit used is shown in figure 1, and if you read last month's article, which dealt with hardware random number generators, you will probably recognise part of the circuit. The hardware of the analyser consists of a 16-bit shift register connected to form what is known as a 'ring counter' or 'chain-code generator'. This generator is used as a data-compressor to produce the signature of the incoming data. The data, as it comes in, is Exclusive ORed with the other feedback lines of the ring-counter. There is a reset line so that the counter can be made to start at zero at the beginning of each test.

This is all that is required at the heart of a signature analyser, but commercial units are self-contained in that they have their own display to indicate the

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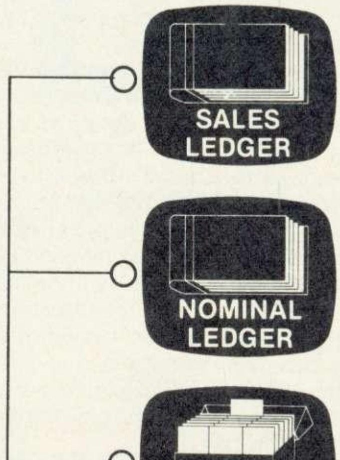
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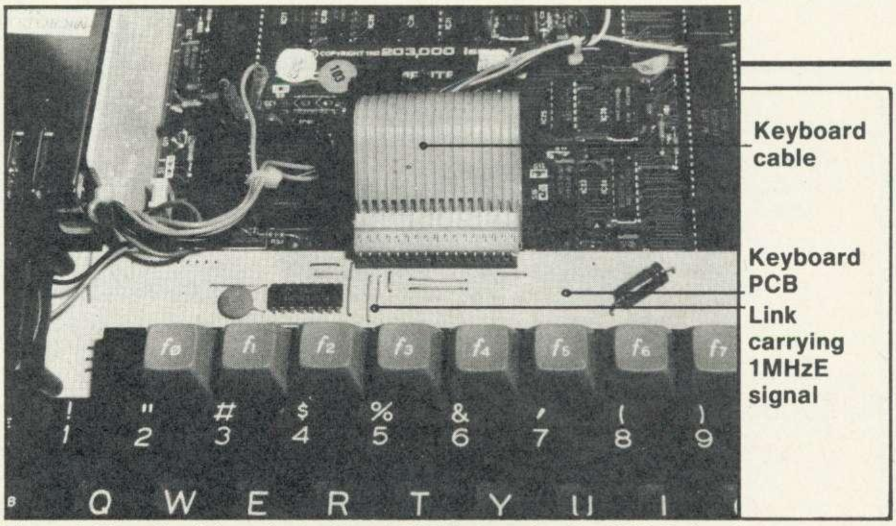


Figure 2. The wire link on the keyboard PCB that carries the 1MHzE signal

signature obtained – usually a modified seven-segment display. In our case, to cut the cost down, we use the computer itself to read and display the signature. The number held in the two eight-bit registers is read into the micro by using the shift register on the 6522 VIA. To do this, the PB7 line is used to disable the normal clock pulses and allow the pulses coming out of CB1 to clock the registers as the data is read into the VIA on CB2. PB0 is used to reset the registers.

Care should be taken to keep leads as short as possible and adequate decoupling should be provided as suggested on the circuit diagram. The clock signal used during the analysis is the 1MHzE line, which is easily available on the keyboard PCB as shown in figure 2. This line is used in preference to the 2MHz line because much of the input/output, both internal and external, takes place at 1MHz. Thus if a 2MHz clock is used it is difficult to obtain a stable signature.

Even when the 1MHz clock is used problems are caused by the dual-speed clock that the Beeb uses (1MHz/2MHz). You will find there is an occasional variation in the signatures produced on the data lines, usually only of 2 or 4 in the least significant hexadecimal digit – ie, there's some variation in one of the last three bits of the data stream. This takes place as the 6502 is reading the value held by the VIA. Such variation should not, of course, be taken as an indication of a fault in the circuit.

Apart from having the test leads as short as possible, it is a good idea to screen them. If they are not screened and the lead carrying the 1MHz clock

TEST	1	2	3	4	5	6	7	8
+5V	EDC7	B752	DB66	C7A2	8593	B4B8	29DD	B279
A0	515C	B40C	51B0	B747	FD31	D453	A5DB	F071
A1	5329	6159	A24B	B1B2	CFDA	7A1B	92B2	12B7
A2	3373	30D2	3B57	4289	57DC	E8E4	5E0E	64CF
A3	7E20	2C72	FEFE	051F	95A3	30CC	68D8	C03C
A4	ACA5	EF96	4A33	273E	02C5	5284	2E19	04D8
A5	ECEB	2B91	155F	8AA9	738F	135E	788C	5851
A6	8F3A	3A25	0185	E74A	4FB8	FDB4	A110	339B
A7	9463	516C	0D83	90B4	A3ED	8068	F03D	5D5B
A8	0DF2	AC41	1B0A	9279	A3ED	3732	5EF9	75E2
A9	B5E1	9A5E	0002	0006	4F6F	B7E4	E81C	EB2C
A10	55D6	814F	C06C	E038	267E	838A	7724	C79B
A11	E035	814F	C06C	55DB	267E	838A	7724	C79B
A12	0002	0002	0002	B5E5	4F6F	B7E4	E81C	EB2C
A13	0002	0002	0002	B5E5	4F6F	B7E4	E81C	EB2C
A14	0002	9A5E	0002	B5E5	4F6F	B7E4	E81C	EB2C
A15	B5E1	9A5E	0002	0006	4F6F	B7E4	E81C	EB2C
D0	2AB5	2C74	75DA	CFD0	769A	B935	AD51	FC97
D1	2BAB	1EF3	5898	9214	BB14	107A	4082	9D34
D2	F41B	A219	B515	DBC2	6135	F004	7B1A	E4CF
D3	EEE4	FB7F	7216	BC38	13D0	6E42	771D	BF7E
D4	9856	06CC	A26E	B60B	CC6F	788C	7BE7	466E
D5	3C1E	7DB8	6E0A	E417	83D0	C230	E0EA	8006
D6	131F	3A15	1FC6	8329	78E8	CAD3	C6EB	9116
D7	EA8C	857D	708C	1337	83D4	9A2C	0A67	15DC
R/NW	E057	812D	C00E	E07E	2638	83CC	7746	C7DD
sync	B710	8A46	D8AD	2790	70A8	056C	D7BE	DCD9

Table 1. Signatures on the main processor bus lines for each of the eight tests

Test 5		
VIAA (IC 3)	pin 23	CAFA
Test 6		
8271 (IC78)	pin 7	9EFA
	pin 9	0007
	pin 24	035A
Test 7		
Video ULA (IC 6)	pin 17	AD53
	pin 18	A89C
	pin 19	9305
	pin 20	9F02
	pin 21	93F9
	pin 22	E0E8
	pin 23	2EF5
	pin 24	E279
	pin 28	29DC
Test 8		
ACIA (IC 4)	pin 9	08D7

Table 2. Signatures for various test points on specific ICs

signal is brought anywhere near the data input lead, you may find the signature becoming unstable.

Software

The operating program (yellow page 107) is written in a reasonably structured way and should be more or less self-explanatory. The display it produces is a line of text asking for the number of the test to be carried out. This information remains on the screen, while the results are shown in a text window underneath. After selecting the test required and pressing return, you can either have that test running repeatedly, displaying the results on a scrolling screen, or do the test once at each test point. For a continuous output, press Return again.

If any other text is typed in it will be displayed on the screen and then, when you press return, the test is carried out once and the result displayed opposite the text that you entered. This enables you to type in the name of the test point and then do the test. For example, you could put the test probe on the first address line, type in A0 and then Return, and the signature for the A0 line would then be displayed. You can use CTRL-B to switch on the printer and CTRL-C to switch it off, so you can produce a printout of the signatures for the various test-points on each of the tests.

If you want to change to a different test, press Return followed by N (for Next) and it will go back to displaying the prompt, which asks for the test number. If you are using a printer, switch it off before you do this. The sequence is 'CTRL-C, return, return, N'.

As it stands, the program offers eight different tests covering the lower half of the RAM, the upper half of the RAM, the upper and lower halves of the ROM, the internal VIA (VIA-A, IC 3), the disc controller chip (IC 78), the video ULA (IC 6) and the ACIA (IC 4). Any further tests can be added to the end of the existing tests, simply using the same format. The signatures resulting from these eight tests are given in Table 1, and some of the signatures at particular points on the ICs in Table 2.

These signatures should be the same whatever machine you are using as except that, as already mentioned, you tend to find that the signatures on the data lines are different by either 4 or 2 in the least significant hex digit. Having said that, you may find certain variations and, considering the amount of data in table 1, there's more than likely to be one mistake or more.

Ideally you should make up this unit before your computer goes wrong. You can test out the routines on your machine and make any necessary changes to the list of signatures.

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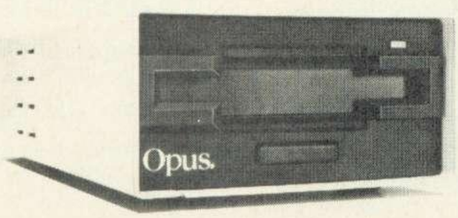
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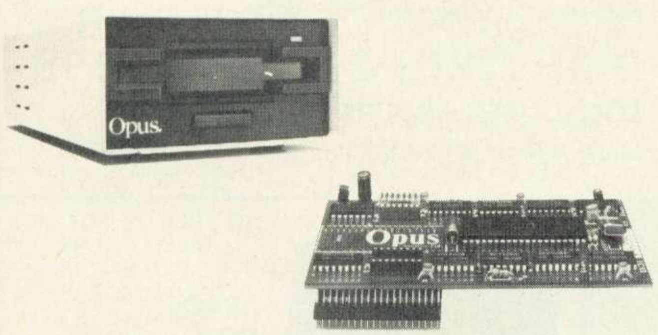


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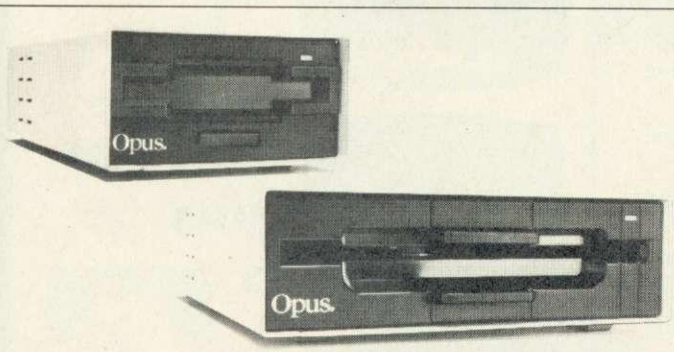


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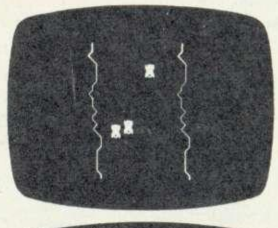
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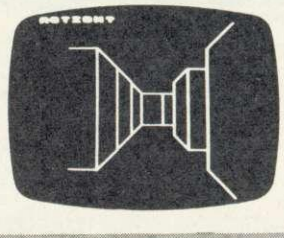
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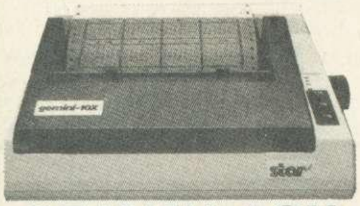
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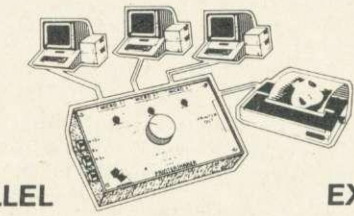
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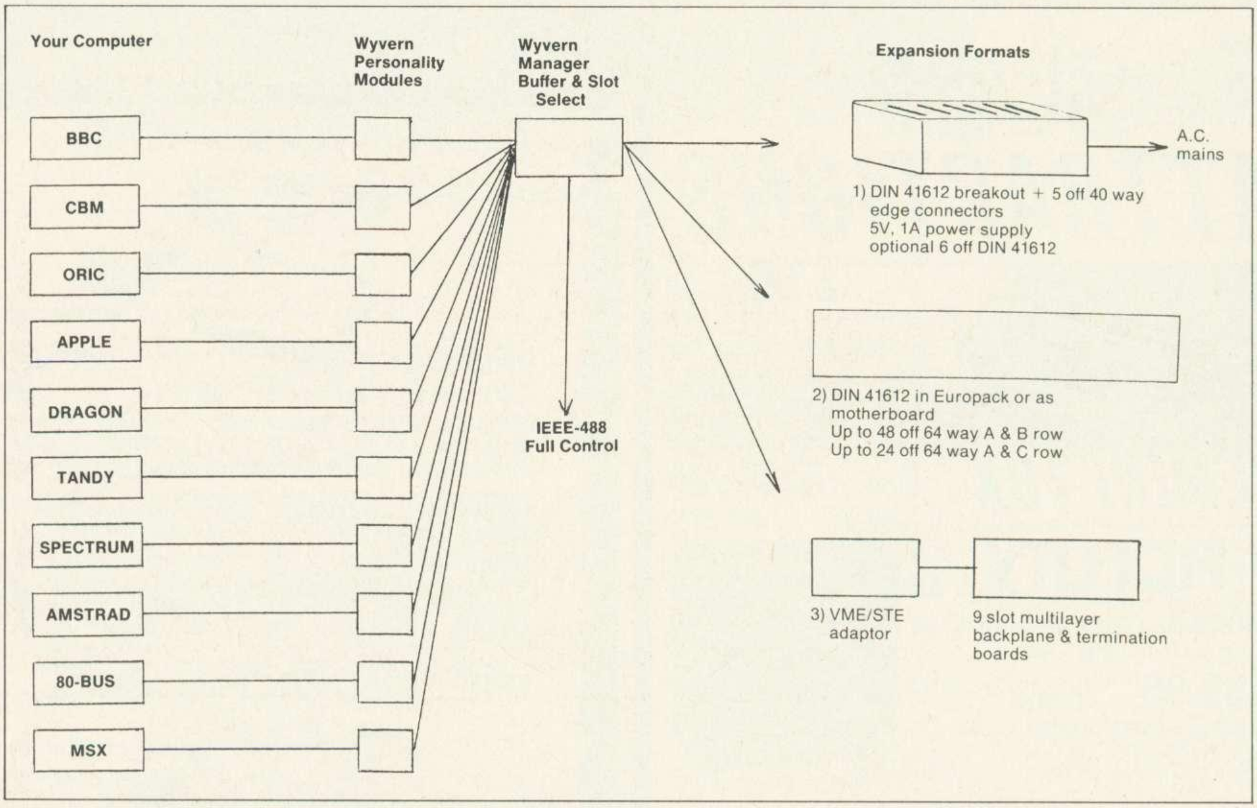
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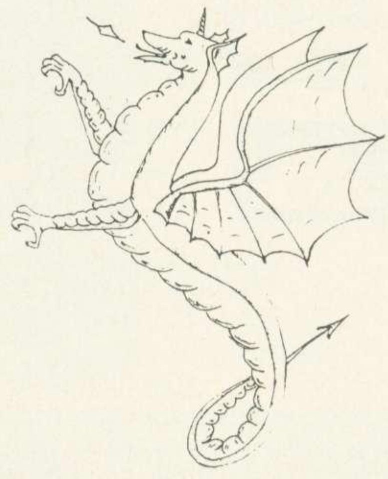
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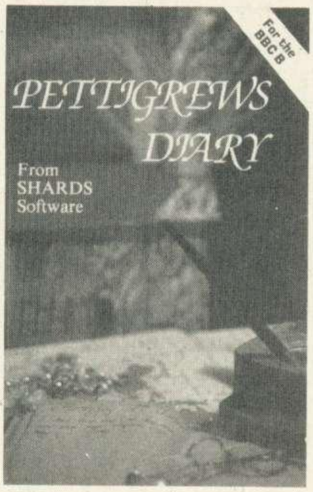
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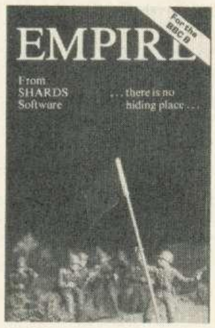


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COULD DO BETTER

Despite the government's micros scheme progress is patchy in primary schools, argues Geoff Nairn

IN A BLAZE of publicity Prime Minister Margaret Thatcher announced the Micros in Primary Schools Scheme in July 1982. By the end of this year every primary school in the country should have a microcomputer, which should be making a valuable contribution to all areas of the primary curriculum. Well, that's the theory. With just three months to go, it's worth examining how successful the scheme has been to date and whether the Government is on target.

Under the scheme, a school can buy a single micro for half price, with the Department of Trade and Industry footing the rest of the bill. The machine has to be British, hence the choice of a Sinclair Spectrum, a Research Machines 480Z or the BBC model B. To date 20,000 of the 27,000 primary schools in England and Wales have taken up the offer, and 80 per cent of these have plumped for the Beeb. The Electron arrived too late for the scheme.

As a comparison, the earlier Micros in Schools scheme for secondary schools boasted a take-up figure of 100 per cent when it closed in 1983. In fact their pound-for-pound subsidy has been extended so secondary schools can upgrade their Beeb with a disc and Econet interface, and buy both a Walters dot-matrix printer and a Microvitec monitor – all British makes again. For the more ambitious schools, a BBC Buggy and a Vela instrumentation kit can also be bought for half price.

For the primary school the situation is rather different. Once you've bought your Beeb, apart from a monitor and cassette recorder, that's your lot. No follow up scheme is planned – in the words of Kenneth Baker, the Minister for Information Technology: 'The DTI is yet to decide whether further schemes of support are necessary.' If no further support is forthcoming, then it is difficult not to see the primary scheme as anything more than political propaganda.



Kenneth Baker: 'DTI yet to decide on further schemes'



One computer per school is unlikely to make much impact but it is all government funding allows. For extra machines, school must rely on their LEA or on parents

That may seem a rather harsh view, but one solitary micro in a school of 350 children is unlikely to make much impact, especially if precious time has to be wasted loading programs in on cassette. Just from talking to teachers around the country, the one thing they really want is a disc drive. And although some local education authorities (LEAs) have set up their own disc drive subsidy schemes – Nottinghamshire and Walsall for example – there is clearly a case for a nationwide initiative. The one argument that there are no British drives available no longer applies, for a company, Dual Track Technology, now make such a thing.

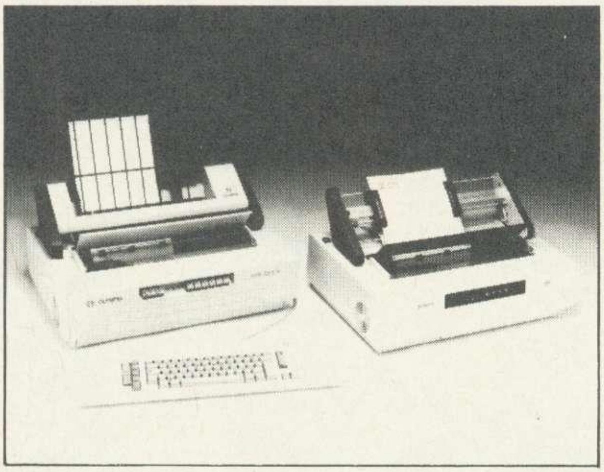
The Department of Education and Science (DES) oversees the primary scheme through the Microelectronics Education Programme (MEP). The MEP, to quote the blurb, 'aims to help schools to prepare children for a life in society where computers are commonplace.' But the MEP has less than two years to finish the job; the group is due to be wound up in March 1986. Of course, the MEP sees itself very much in a 'pump-priming' role, the idea being to provide the initial hardware, software and training, and after that the LEAs should take over. The trouble with that argument is that different LEAs have different priorities: the much-publicised 'league table' of LEA spending shows that on something as mundane as textbooks the 'top' authority spends six times as much per pupil as the one at the 'bottom'. It is difficult to make a case for more computers if the schools in your county do not have enough money for textbooks. With the current financial restraints facing all LEAs, what may seem like pump-priming to Sir Keith Joseph to others can seem like an abdication of responsibility.

In fact, this theme of self-reliance and 'hoping' that LEAs take up the challenge seems to permeate the whole primary scheme. With training, for example, the DES makes it a requirement of the subsidy scheme that two teachers go on a two-day course on using their micro. In two days, a teacher who has never used a computer before can just about get the hang of operating the Beeb – plugging it in, using the cassette recorder etc. To expect that teacher to then start using the computer in a challenging way, or

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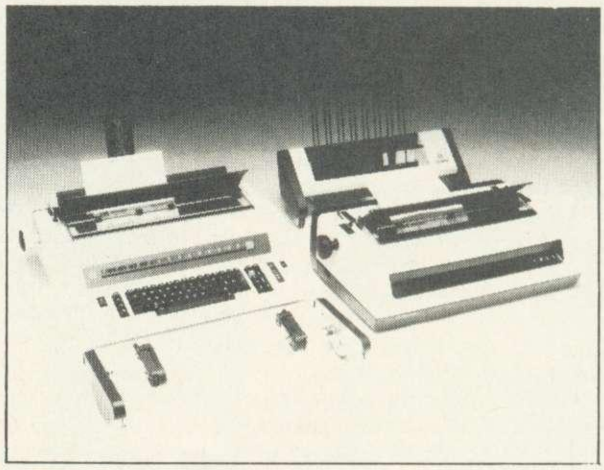


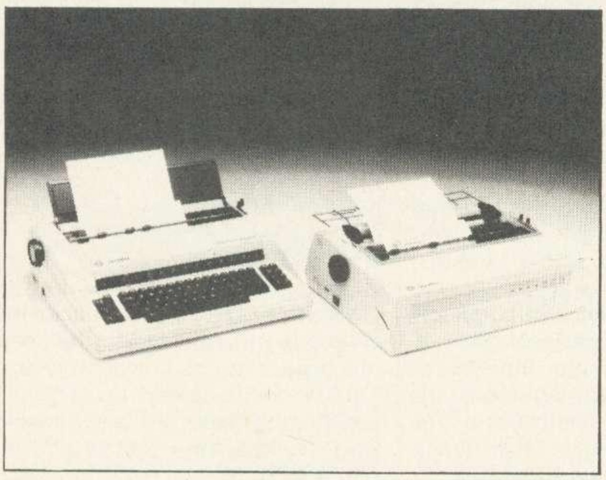
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Interface: RS232 IEEE, Centronics.

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Pitch: 10, 12, 15 characters/inch proportional spacing
Line length:
141 characters with 10 pitch
169 characters with 12 pitch
212 characters with 15 pitch
Paper feed: Variable, 96 positions/inch, Bidirectional, indexing one half space up/down.
Printing: Automatic bold, (1/120″). expand and double print. Automatic bidirectional printing with shortest path seeking. Automatically skips over blank fields.
Buffer: 4 k byte.
Keyboard option. Qume control code. Option for Wordstar.
Function controls led:
102 ON/OFF-Line. Error.
103 ON/OFF-Line. Error. Bold print.
Expand print. Double print.
Interfaces: RS232, Centronics IEEE.





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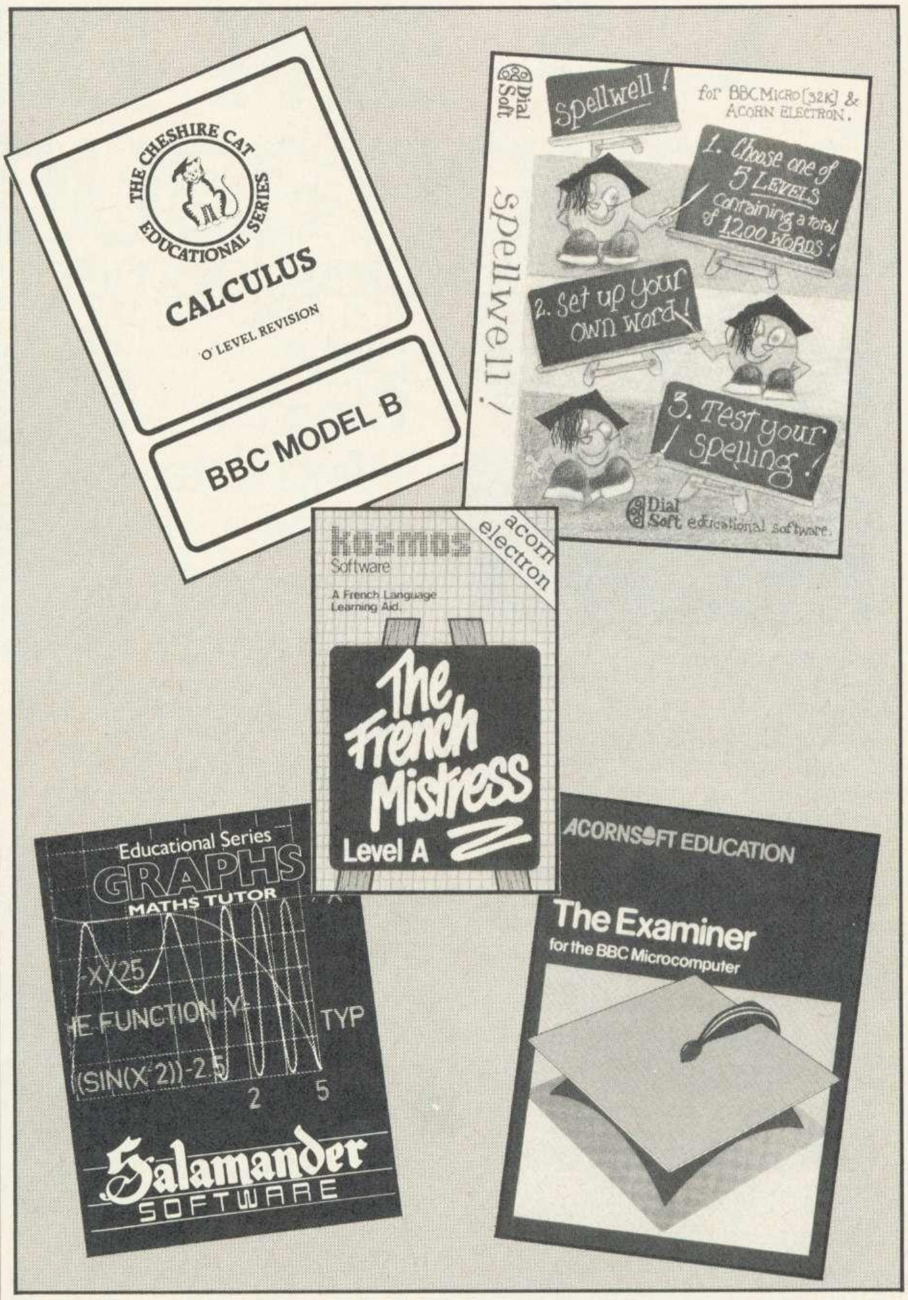
even to pass on precious knowledge to other teachers, is a mite ambitious. Many education authorities do go beyond this minimum level and set up excellent in-service training courses – Walsall, for example, runs 25 different computing courses for teachers. But many do not.

One criticism levelled at the MEP by the NUT (the teachers' union) especially is that they have tended to concentrate on developing software rather than training courses. There is little point in producing educational software if there aren't the teachers who know how to use it, says the NUT. To meet such criticism, the MEP set up a small primary project team in September 1983, to assess the needs of primary schools in both teacher training and resources. They still don't actually train teachers though, rather they train computing advisors who then go out into the regions and train the teachers.

On the question of training, you would naturally imagine that the colleges of education, who after all are responsible for training tomorrow's teachers, would be at the forefront in this area. Again, a few colleges do run courses in educational computing for all their potential teachers, but sad to say they are the exception rather than the rule. Two primary school teachers I talked to, who had both graduated within the last two years, emphasised this point. One said that computers had not figured on the syllabus of her college at all, while for the other his computing experience was confined to one afternoon's demonstration of arcade-type games.

And so we come to the all-important software. In 1982, when the scheme first started, BBC micros were a bit thin on the ground, as was educational software to run on them. The MEP helped to spawn several software groups such as Netherall, Five Ways, the Chelsea Science Project and ITMA who did – and still do – come up with some sound educational software, although most of it is for secondary school subjects. Since that time a variety of software houses have started producing Beeb software for primary schools. Now, the problem is not one of a lack of software, but rather how does a teacher find out what's available and whether it's any good? Still worse, where does the money come from to buy software – educational software invariably costs more than the average 'arcade' game.

Talking of software, the MEP is the body responsible for the Microprimer pack, which comes with every Beeb bought under the DTI subsidy scheme. It aims to be an introductory 'self study' course for teachers, so that they can at least get started using the Beeb in their classroom. Unfortunately it is often the only software a school has – apart from the Beeb's Welcome tape that is. As the MEP is the first to admit, the Microprimer pack was developed in a hurry and to meet a specific need. It would be a shame if teachers judged all primary software on the basis of one package.



There's plenty of educational software available now but most is for secondary schools. Educational programs cost more than 'arcade' games and there's no government money to buy software

Is the primary scheme a success? Well, I do not doubt that by the end of this year pretty well every primary school will have its very own micro – and most of them will be Beebs. Quite a few will be locked away in store cupboards because no one in the school knows how to use them. On the other hand others will be in use every day, with children of all ages and abilities feverishly tapping away. And a good few more will be wheeled out on Friday afternoons for the 'computer lesson', which consists of teacher typing and children watching.

And so, what for the future? Number one priority: every teacher should at least know how to use their Beeb. A disc drive would be nice as well. Oh, and a few more Beebs wouldn't go amiss. A tall order? Not if the Government is serious in preparing children for the future. As a spokesperson for the DES said, 'It's very easy to criticise the scheme, but no other country has done anything similar.' It's also very easy to be complacent and make political capital.

FRAMING THE RIGHT QUESTIONS ? ? ?

Ian Birnbaum reviews Acornsoft's Microtext system, a powerful aid in programming instructional modules

MICROTEXT is an authoring system. It was designed by the National Physical Laboratory, implemented on the BBC micro by Ariadne Software, and is published by Acornsoft in cassette and disc form. My comments are based on the disc version.

An authoring language aims to allow the programmer to implement training and instructional programs easily and efficiently by providing special facilities for dealing with common situations. For example, scanning a student's answer for one or more keywords and then branching if they are present is complicated in Basic, but easy in an authoring language. Indeed, Microtext claims to be so easy to use that, for some cases at least, the designer and encoder of the module need only have a cursory knowledge of programming.

Microtext has its origins in a computer system called Mickie, a medical interviewing computer, developed in the 1970s. It used a language called Questext which allowed doctors to set up modules without extensive programming knowledge. Questext was extended to cater for more varied training on (non-micro) computers, and became Edutext. However, Edutext in Basic was slow and bulky, so it was rewritten in assembly language and implemented on micros; this is Microtext.

Advantages

The easiest way to describe Microtext is by considering the advantages it offers over Basic. This gives the correct context because the system stands or falls on its ease of use for the purpose of creating instructional programs.

There are many advantages to the system in this respect. First, Microtext is **frame-oriented**, ie the essential unit is a screenful of information, a frame. In this sense it is very like viewdata systems. However, it is more sophisticated in that control information is part of the frame itself. It therefore combines the ease of use of viewdata with the flexibility of a programming language.

In Basic, the relationship between a screenful of information and the instructions required to produce that frame and to branch to another is exceedingly opaque. The programmer has to project from language to screen to provide the link: Basic offers no real assistance in itself. As a consequence, debugging by frame – the natural approach – is not easy. In Microtext, it is simple because the programmer creates one frame at a time by placing characters on the screen in the position they are to appear when the program is executed. In the frame, control information is included that instructs the computer which frames to branch to next and on what criteria.

Microtext allows simple **debugging** as it is simple to switch from running or testing to editing a module. If the frame layout is not correct, or an unexpected branch is made, pressing the escape key followed by S (for Stop) switches to a full-screen editor. The system offers single-stepping through the frames if required.

When most instructional programs are run – in Basic or any other language – errors that occur are usually observed at the frame level or at the link between frames. In Basic, this does not assist debugging, but in Microtext the link is absolutely clear, so errors are easily remedied.

Microtext offers exceptional facilities for accepting **user responses.** The programmer can specify whether spaces are to be ignored between words; whether an exact match is required or whether a response should contain, begin with, or end with a set of characters. The programmer can combine separate criteria using 'or', 'not' and 'and' (ordered or unordered) to produce complex branching decisions. Both textual and non-textual data are supported, and with the latter numeric-range tests are available (eg, less than and greater than).

There is no need to compare these facilities with Basic: there is no contest!

A programmer can **design a form** on the screen with headings, and when the frame is run the cursor will move from heading to heading as the user responds. In this way complicated forms can be set up with minimum trouble.

Microtext allows a **complete summary** of the user's responses to be created. In instructional programs, it is very useful to store these for later analysis. This might be used to give the student or teacher a record of achievement, or to record in variables information required for future modules (a module is a collection of frames, all loaded into memory at one time, which constitute the file being run). Microtext implements both these approaches, the first simply, although the latter is rather more complicated.

In Basic none of these facilities is provided, and the programmer must save the relevant information, and generate appropriate screen displays.

If the user types **Help** (or even just ?) in Microtext when responding to a prompt, the system automatically branches to a help routine, if one exists. Typically, the first help frame will be a menu with a variety of choices (eg, start again; get help on this topic or on this question). Each frame can contain a different destination frame if required: this is achieved by putting HELP followed by the frame required.

In Basic, it is possible to create a similar system by using a common input routine which always branches when Help is entered. However, this is by no means a trivial task.

There are two sorts of **variables** in Microtext: system variables and user-defined variables, ie reserved words which hold specific information. These

The Microtext system (including manual) costs £49.85 for the cassette version and £59.80 for the disc, available from Vector Marketing, Dennington Industrial Estate, Wellingborough, Northants NN8 2RL. Tel: 0933 79300. (Acornsoft is on 0223-316039).

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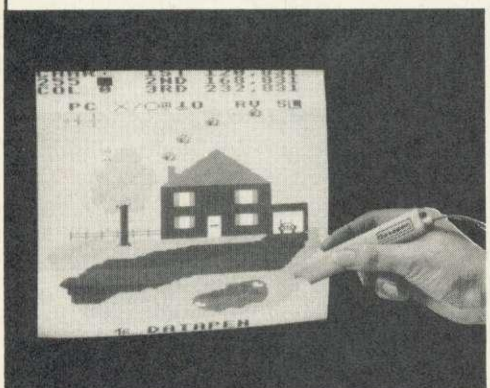
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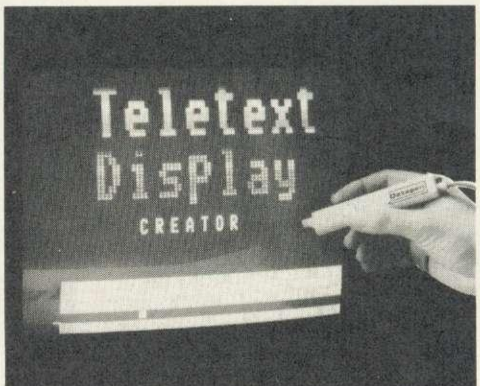
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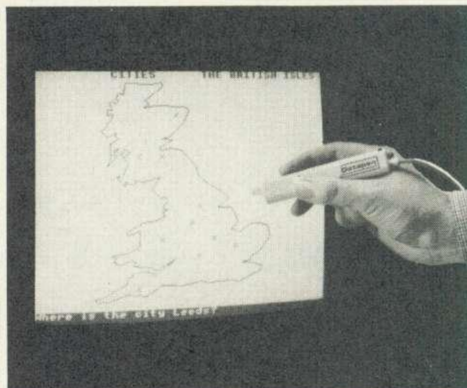
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are ANS (holds the last answer given), TIME (contains the elapsed time since last initiated) and RANDOM (generates and holds a random number). User-defined variables are similar to Basic's, but it is not necessary to differentiate between string and numeric variables. The contents of a variable may be displayed by use of angled brackets; for example, if NAME contains the user's name, then:

Are you ready, <NAME>?

will give a personalised question. Moreover, a list of variables can be created using something like =PLAYER<NUMBER>, where NUMBER is a variable incremented elsewhere, giving separate variables PLAYER 1, PLAYER 2 etc. This powerful feature is not available in Basic.

All * **commands** in the BBC's operating systems (and so all *FX commands)

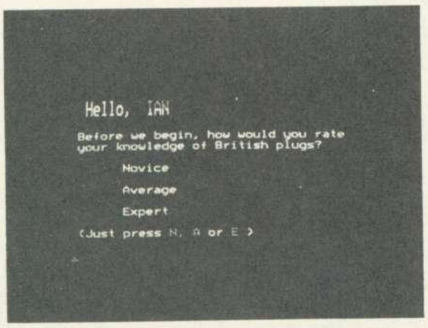


Figure 1. Student's view of first frame in example module testing knowledge of plug wiring

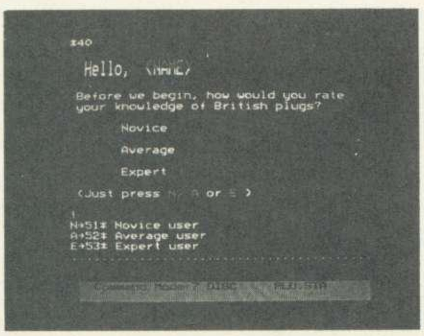


Figure 2. The whole of the first frame showing the hidden commands and branching to further frames

and some VDU commands (including sound and graphics) are available directly within Microtext. (Although not documented, the cursor can be turned off and on with $CH1,0,0,0,0,0,0,0,0 and $CH1,1,0,0,0,0,0,0,0 respectively.)

Microtext offers easy control of input/output at the **user port.** The programmer can set a specific line high or low, or wait for the line to go high or low: particularly useful for slide and video control.

Microtext modules (eg, a self-contained lesson) are **portable** both between packages on the BBC micro and between machines. In the former case, a wordprocessor could be used to set up a frame: each frame is stored in ASCII (although text compression is used). In the latter case, it is important only to use graphics commands which exist in all systems (eg for Commodore systems there is no point using teletext colour and graphics).

Microtext contains **error checks** to ensure material is not overwritten. Thus, if you edit a module and then attempt to load another without saving the first, a message appears. A simple safeguard, but important.

Disadvantages

No system is perfect, and there are some disadvantages to Microtext when compared to Basic, but they by no means overshadow the advantages. Let us consider them briefly.

Microtext supports only integer arithmetic. This clearly presents some restrictions, which is a pity with, for example, maths.

Microtext is not structured. All control in a program is achieved via conditional or unconditional branches (ie the equivalent in Basic of GOTO, or IF. . .THEN statements. I don't regard this as a handicap because, as a frame-orientated system, the structure is already incorporated.

Memory is rather short with cassette and disc versions: about 14k and 11k left for mode 7 programs respectively. This leaves room, just, for a 30-frame module in the disc version and 40 frame with cassette (lots of variables will cut these down). On a disc version this is not problematic, since one module can call another.

The memory problem can be solved by a second processor or the ROM. These options are essential in a graphics mode: mode 4, for example, allows just six frames. Modes 0, 1 and 3 are impossible without the second processor or the ROM (modes 2 and 5 are never supported).

At present, the Microtext package is needed to run any module. However, a delivery system (without the editing facility) will be available which sits securely with the module and is loaded with it. This is produced by a publishing system, and will be very valuable for, say, education authorities that wish to produce packages in a resource centre for schools. Questions of copyright have yet to be fully resolved.

There is no simple access to the contents of the analogue port from Microtext, except by using *FX128 and getting the values of the X and Y registers. Nor is there access to a printer from within a module (ie no VDU2 or VDU3). The only access is at command level to print copies of frames, or to dump the summary (these may be activated at RUN time by preceding them by $). However, I'm sure someone will find a solution.

The COPY key is not available for normal use in edit mode; instead it

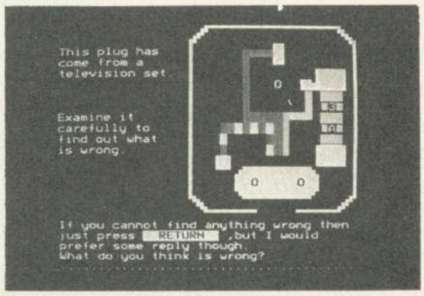


Figure 3. Pressing 'N' at figure 1 takes us to this, frame number 51. NB This is NOT the correct way to wire up a plug



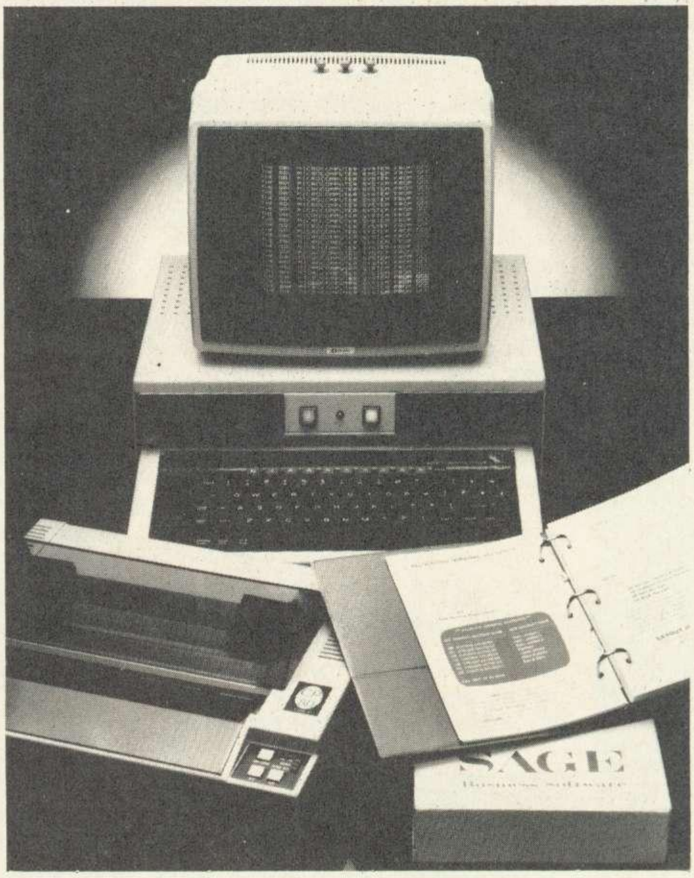
Figure 4. This next frame is where the problems begin with free range of response. NB This is NOT the correct way to wire up a plug

pushes a space into a line and moves the rest of the text to the right by one character without wrap-around. This is a pity, especially when one considers the eighth disadvantage – there is no teletext graphics editor. This makes creation of double-height characters tricky, and mode 7 graphics laborious. All teletext control codes need two function key presses to make them active (in other modes these produce foreign characters eg ê): this is also tedious. However, inclusion of a full teletext graphics editor would have left less space for modules. There are two solutions: use a graphics editor on a chip which can be used via a * command, or a separate package to create a frame and then load it in ASCII into Microtext. However, to do this it will be necessary to incorporate it within the existing module in some way, because Microtext does not allow subsets of modules to be loaded. Again, someone is bound to find a way round this.

Microtext in use

Microtext comes with a 120-page manual, a reference card and a demonstration package. The manual is comprehensive, though not that easy for beginners. I think Microtext is accessible to newcomers, but I suspect a

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course may be necessary to help them.

As an example of Microtext in use, let us look at the PLU.STA module supplied which tests the student's knowledge of 13 amp plug wiring. It is an interesting attempt to allow a very free range of response, and I think it almost succeeds.

The module is loaded from Microtext by typing RUN PLU.STA. After the title, the student's name is asked, and he/she is then asked to rate their knowledge of plugs (figure 1). Let us see what set of program instructions produce this page. We press Escape and then S (for Stop) – we get figure 2. The ! indicates that only a single key press (with no carriage return) is allowed. On pressing N, the program will continue from frame 51, and the statement 'Novice user' will be saved to the summary; similarly for A or E. If any other letter is pressed, the statement 'Not understood – try again' is displayed in red. We could generate our own response on another frame (say on frame 55) by putting →55 at the end. Notice finally the use of <NAME> to display the contents of the variable NAME (in this case IAN).

Frame 51 sets up appropriate text, initialises a variable which limits the number of wrong answers allowed, and then, after a few prompts, directs the student to a picture of the plug with a question (figure 3). Typing 'earth wrong' produces the response 'I would like a more specific answer. Precisely what is wrong?' If, on the other hand I type 'Wires crossed' I get 'Yes, two of the wires have been crossed but I would like to know which ones. Which wires have been crossed?'. If, now, I type 'Earth and neutral' I am judged correct. This is a nice sequence, and easily implemented.

We continue now to plug B (figure 4). I type '3 amp too small' and get the response 'It seems that you don't know what is wrong with the plug . . .'. If instead I type 'Fuse too small' I get 'What is wrong with the fuse?'. But if I had put 'Fuse wrong' as my answer, it would have marked it correct and said 'Well done'. Clearly there is something wrong! Let's edit the program.

The relevant frame for our purpose is 210 (figure 5). This says that any combination of the word fuse and one or more of blown, low or wrong are accepted as correct: the word fuse with any other words goes to a prompt at frame 270; otherwise we are told we are not correct and allowed to try again. (Incidentally, the system does not differentiate between upper and lower case.)

We shall change the first line to:

```
(<FUSE>) & BLOWN/LOW/SMALL/
13 AMP >280
```

and the second to

```
<FUSE> >270
```

At *210 we define the variable FUSE by (FUSE = "FUSE/3 AMP").

This solves our problems, and also allows 'Fuse should be 13 amp' and similar answers. Moreover, it treats 'Fuse is wrong' as only partly right and responds with 'What is wrong with the fuse?'. Notice, finally, that Microtext will treat both 3 amp and 3amp as the same.

We see from this how easy it is to edit, but we haven't perfected the program. We need to edit other frames to be consistent with the changes we've made, and more crucially, we still haven't caught all the right answers. The moral from this is that even the simplest module that uses free format responses will need considerable testing and editing.

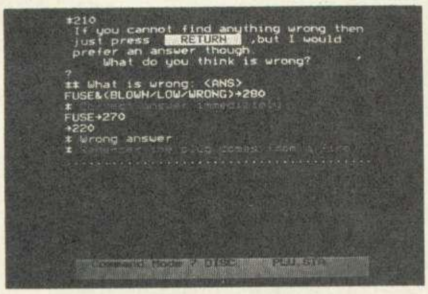


Figure 5. Looking behind the scenes shows responses that are allowed, and the prompts given

Microtext makes editing easy, but there is no substitute for careful educational design and thorough testing: indeed, the powerful facilities of Microtext make this even more important.

In this example, we have been examining the program in RUN mode. When editing, we momentarily entered COMMAND mode and directed the system into EDIT mode. Then back through COMMAND mode to RUN mode again. This process is adequate for testing and debugging, but Microtext provides one further mode precisely for testing: TEST mode. Without too much detail the essential differences are that it is more difficult in TEST to delete or overwrite an edited module without saving it, also the Escape key always fully interrupts a program.

Most of the other facilities are available in RUN or COMMAND modes, though some are slightly more convenient to use in TEST mode. It may seem then that TEST adds virtually nothing new, but this is not so. Most programs will consist of a whole series of modules and it will often happen that one module will call another. When testing a system, we don't want to lose our edited module in this way – hence the need for TEST.

On balance, the introductory package of modules is well-thought-out and reasonably varied. The average user will gain much from working through the modules, examining how they were programmed and – most importantly – altering the modules as we have done here.

Educational implications

Used with the right application, Microtext is very valuable. I believe it is possible to teach relative beginners how to program with the system, thus opening the way to program designers implementing their own code. However, more advanced uses (eg, creative uses of variables) and the implementation of complex teletext screens will require a more professional approach. There is no doubt, though, that the use of Microtext will make the professional programmer far more efficient, given the right application.

The great danger with Microtext, however, is that its very ease of use will encourage teachers and LEAs to program with it, and thus restrict the types of program available. Microtext can only be used to implement programs which are susceptible to frame-by-frame analysis. This is a wider range, certainly, than straightforward instructional and training packages – for example, adventure games are possible, although there would be severe memory constraints – but it is a distinct subset of educational software. Packages that use animation will not be viable, as far as I can tell; and, of course, no more than four colours will be available; moreover, as we have seen, only integer arithmetic is possible. And, more generally, not all educational design intentions can be accommodated by a frame-oriented language.

However, this said, Microtext clearly points the way, and with Microtext Plus on the horizon, which should allow floating point arithmetic, a full interactive graphics editor and some expert system techniques incorporating generative rules, I think we will see the decline of Basic as a language for computer-assisted material in education and training.

Microtext is a superb technical achievement for a 32k machine, and I look forward to seeing what creative educators can do with it. I regard it as a tremendously important development, and quite possibly the shape of things to come in the construction of instructional and training packages, especially in conjunction with video disc technology.

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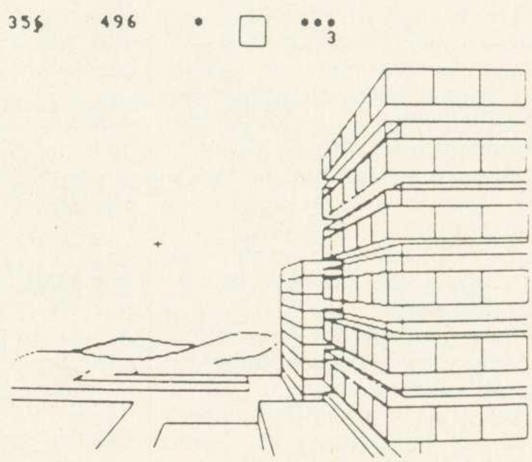
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ATOMIC TEXT

Alex Wilson cures writer's cramp with 'Wordprint'



SELDOM is the inexperienced owner of a printer offered help in the manual that comes with the peripheral. It's no longer a matter of attaching a cable and off you go – there's a lot more to a printer than an electric typewriter. For a start, different type-styles are available at the press of a few keys. Yet working from the manual produced the following comment from one newcomer to printing: 'I eventually worked out how to use the printer in text mode from the single example of how to enter control codes given in the Epson booklet.' Try the Star Gemini 10X booklet (reputed to be better written than previous ones)! It doesn't even have one example. Many users are therefore unlikely to get value from the machines they buy.

My program will, I hope, tender a guiding hand to frustrated beginners. *Wordprint* is a wordprocessor program written for domestic use on a 12k RAM Atom driving a Gemini 10X printer, and it should cause little trouble with a Beeb (the cable is the same as on an Atom) or an Epson (if George Hill is right about the control codes). It is offered for those who do not have the money to spend on a commercial wordprocessor.

So how do you get at all those extras you've paid for – italics, variable characters per inch, underlining, subscripts and so on? (Forget about screen dumps and downloading characters – time enough for them when you find out how to include the others in your programs.) Master the control codes first then it must be easier. These are shown as CHR$(27) CHR$(n) . . . , or ESC n . . . but how do you get them into your program? You can't stop and press Escape-this or that, so it's as well to understand what is required. Those who already know can skip over the next few paragraphs.

The printer expects items in binary form from the computer. Some in ASCII will be numbers and some letters. Then there will be control codes, which will not be printed. The escape code is the most frequently needed and on receipt of a byte containing 27 the printer interprets this as a change of instruction.

The difficult codes are $2 and $3 or CHR$(2) and CHR$(3), as these enable and disable the printer, in particular $27$66$2 and $27$66$3, which set 12 characters per inch and 17 CPI.

Try entering

```
PRINT $2; PRINT $27$66$1; PRINT
"HELLO"';
```

Your printer should print HELLO as you expected it. Now change it to read PRINT $27$66$2 and then $27$66$3. In theory these ought to change the print to 12 and 17 characters per inch respectively. Instead it is probable that HELLO was printed out exactly as before and then nothing at all for the instruction with $3 in it. These can be dealt with successfully by putting the value into A then applying LINK #FF10, for this enters the printer driver after the switch.

Other controls can be sent directly with say, PRINT $27$61, which sets bit eight to 0, or as part of a string. For example, if a string is ABCDEF, sent to the printer as /27/53/A/B/C/27/52/D/E/27/87/1/F, then the first control sets standard ASCII, and ABC would be printed in normal print, the second control sets italics and DE would be in italics. The further control sets enlarged mode so that F will be enlarged italics. Note /N/ is to indicate that we are talking about a single byte number, not to be confused with 27 which would normally be sent and printed as 2 followed by 7, i.e. ASCII 50 and 55.

If you are unsure of this try

```
B= 2800; ?B=27; B?1=66; B?2=3;
I=0; DO; A=B?I; LINK#FF10; I=I+1;
UNTIL I=3; PRINT"  HELLO"'.
```

This should get HELLO printed at 17 CPI. Alternatively, start a new program at #2900 with

```
10 REM31221;
```

This will list just as you typed it. Now type 10 REM and three spaces and return. Poke 0 into each of the spaces (#2906-#2908) and LIST. This will appear to be 10 REM and little else. Follow this with

```
?#2906=3; ?#2907=12;
```

These are Atom control codes. Listing will switch off output to the printer and will clear the screen. You have just done PRINT $3 $12. Alter the last 0 with ?#2908=21; then you have the equivalent of PRINT $3$12$21 which also

page 146 ▶

The 'Wordprint' program is listed in the yellow pages section on pages 109–111

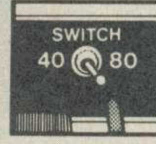
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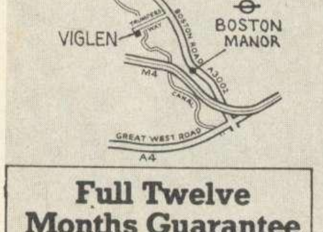
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◀ page 143

switches off the screen. Compare this with the results from the first REM, and you have the difference between printing a number and a control code.

To show this in a working program is the best way to make the point. Written in Basic, *Wordprint* is slow in parts but more understandable than assembler. It is a restricted wordprocessor that uses #2800 as working storage and #2900 for the program. It stores the text from #8200, in the graphic space. It is not excessively user-friendly so an explanation of the program as well as the controls is needed to make it accessible. A sheet of instruction was orginally written as an aide-memoire for the program and this is included below. With the exception of lines 27, 28 and 44, which were taken from *Atomic Theory and Practice,* the program is original material.

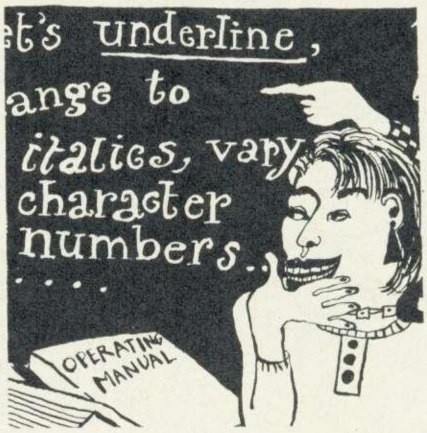
Starting with the printer controls, these are in lines 91–126, 456–458, 470–478 and odd lines between 300 and 440. Several control characters can be embedded in the text and these are searched for in lines 456–458. Lines 91–126 are combined with these to insert the controls into the string B($B), using X as the index. $B has the code 27 entered in the first lines and has the rest dealt with in 91–126. (These line numbers are taken from the ASCII values of the embedded control characters.) After this B is free for further text input. The codes are to set up italics, underline, enlarged, super and subscript and to cancel them.

The routine at line 470 is entered every time a print request is made so that it is immaterial if the printer is switched off in the meantime. A routine such as this is needed in any program that requires printed output, to initialise the printer and to set some print style. It starts by putting the printer 'on line' with PRINT $17, and follows by initialising it, PRINT $27$64. If a headed address is wanted, T takes a value near the right-hand side and inserts it in the tab instruction PRINT $27$68(T)0 as the only tab. The default is that tabs are set at 10, 20 and so on up to 60.

Line 472 sets double-strike printing, if required.

Line 474 uses M to set the left-hand margin at the Mth position. M=10 causes a tab to 10 and then a margin of 10, thus line 232 to avoid this. The right-hand margin is not used, though there is an instruction for it.

Line 476 reads the values from locations #8E to #91. These are put there in line 505 and #8E holds 27, #8F has 66, and #90 has 1. Lines 200–220 can alter the value of #90 to give 12 characters per inch or 17 CPI instead of 10 CPI.



Line 478 ensures that the eighth bit (most significant bit) is 0. The printer sets this randomly which can be frustrating.

PRINT #27$55$0 is to obtain the US set so that the hexadecimal sign is shown as #. This can be altered to give foreign language types. The lines between 300 and 440 have PRINT statements: PRINT $2 and $3 are Atom commands. PRINT $17 and $19 are Star commands. These enable and disable the printer driver and put it 'on line' and 'off line'. (Both sets are included to show the order of use.) PRINT statements do not have to be separate; PRINT $2$27$66$1$27$61 is acceptable to the Atom and the printer instead of PRINT $2, PRINT $27$66$1, PRINT $27$61.

Now for the operating instructions.

The screen shows DATE. Type date or return. Anything input here will be kept as date.

The screen shows Options 1–8:

1 *WRITE TEXT* subdivides into 1-New

```
            1         2
  01234567890123456789012345678
0 tHIS IS AN EXAMPLE OF HOW THE
1 TEXT EDIT ROUTINE LOOKS ON TH
2 E atom SCREEN. tYPING IS DONE
3 IN REVERSE, WITH LOWER CASE B
4 EING USED AS CAPITALS AND REV
5 ERSING THEM IN LINES 453 AND
6 454 BY EXCLUSIVE OR-ING WITH
7 #20. tHIS STOPS THE SCREEN F
8 ROM BECOMING WHITE AND GLARIN
9 G.
A,B,D,I,N,Z?
```

How the Text Edit routine appears on the screen

Text and 2-Additional Text. New Text will start again and all previous text will be lost. Additional Text adds text at the end of current text. ZZ will return to option point. Text can only be added in the middle using EDIT.

2 *EDIT* displays text in lines 0-9; in columns 0–28. Available options are A, B, D, I, N, Z.

A – Amend , change letters one for one

B – Back, moves back to previous screen

D – Delete, deletes a stated number of letters starting from a given point

I – Insert, inserts a piece of text and moves up the remainder

N – Next, displays the next screen

Z – end of edit

Edit errors

'CAN'T GO BACK' – BACK requested but screen showing start of text.

'END OF TEXT' – NEXT requested at end of text.

Print control characters

Left square bracket (ASCII 91) – Italics

Backslash (92) – Underline

Right square bracket (93) – Cancel italics

Up arrow (94) – Enlarged print

Shifted (SH) At (96) – Cancel enlarged

SH left square bracket (123) – Superscript

SH backslash (124) – Cancel underline

SH right square bracket (125) – Subscript

SH up-arrow (126) – Cancel super/subscript

Star (42) – Linefeed

Place PCC immediately before the first letter to be changed. Cancel PCC just after the last letter – ie, before the blank. Include a space after commas and stops. The program automatically left-justifies and looks for the final space in the line.

3 *PRINT TEXT* (sub-option CHANGE PRINT STYLE). Three print styles can be selected: 10 CPI, 12 CPI and 17 CPI. Left-hand margin, lines per page, letters per line, and letter-heading are included in print style routine.

4 *SAVE TEXT* A name up to ten letters is asked for, two Record Tape messages are printed and there's a 10-second delay before the second.

5 *LOAD TEXT* Start tape before the recording. Each file name will be displayed. Press CTRL when the correct one shows.

6 *REVIEW TEXT* shows text as in the edit mode but without line and column numbers.

7 *ENVELOPE* to address envelope.

8 *END* of run.

At the end of each text input 'O.K.' is printed. If 'N' is typed in, the line is not accepted. The screen editing facility is still available in the usual way.

An asterisk during text input will be translated as a new-line indicator. Star-space-star will linefeed twice.

If it is necessary to end the run or ESC or BREAK is used, restart with G.y. Unless this method is used, there may be a loss of data.

page 148 ▶

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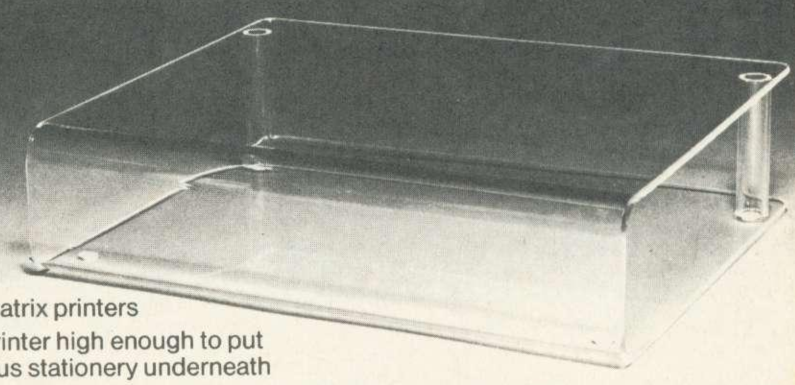
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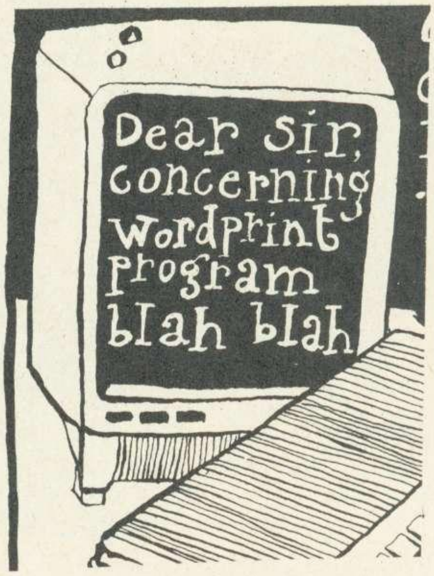
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AU10/3b

Text input uses the normal Atom input so that strings are restricted to 64 characters. The request for a headed address in line 270 uses the WRITE TEXT routine and must also be ended with the string "ZZ". All text input is in upper case. The output to the printer reverses this with: #20 (Exclusive OR 32). This arrangement has been found to be better than locking into lower case and shifting for upper case, because it avoids filling the screen with white-background letters.

Edit falls into two parts: the edit options and the print control characters (PCC). Having edited the English, it is possible to operate on the PCCs using the same options. Each PCC can be entered immediately before or after any other, giving say, italics, enlarged and underlined until each is cancelled. If none is entered then printing is done in standard print. There are about 40 options for the Gemini, some duplicated, but these were selected as being the most useful. If some machine code is introduced to speed up the program then twice as many PCCs can be used by recording the first occurrence as 'on' and the second as 'off', instead of using different signs for each.



The program up to line 71 should be typed without the leading space or REMs. Line 71 is then at #2B57 as required in line 505, which sets the error-handler. The text in line 72 should be re-written to show your address. One leading space is required here, for line 316 needs this to start at #2B69. In line 26 the address of the first character after the quotation mark has to be #298A to make lines 20 and 22 work correctly.

Within each main option, all variables are local. To list all the variables would take too much space. The print options set in lines 200–282 are held in locations #85–#8D. They are unpacked when required in line 300.

S and T are used throughout as string pointers for text. B is the text string and D is used as a general-purpose string.

#8200 holds 13 and #8201 has −1, for use in the dummy file in the Save routine. The text starts at #8204 and each file carries its end address in #8202,#8203.

The strings can be dimensioned if you prefer and BBC converters can carry the print options forward in suitably named variables. They may also find the articles on Beeb to Atom conversion (*Acorn User*, from April 1984) a help. The hardest parts to recognise are the abbreviated statements F., N., IN., G., GOS., U., R. These stand for FOR, NEXT, INPUT, GOTO, GOSUB, UNTIL, RETURN. It woud be nice to see this program followed up shortly with a BBC version. Meanwhile, try your luck with the *Wordprint* editor.

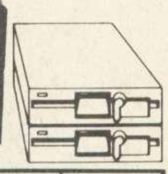
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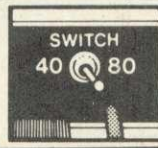
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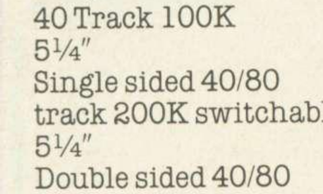
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AU10/3

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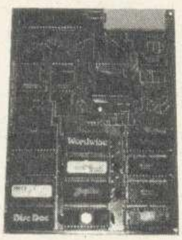
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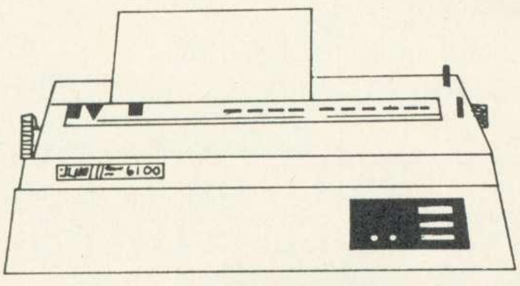
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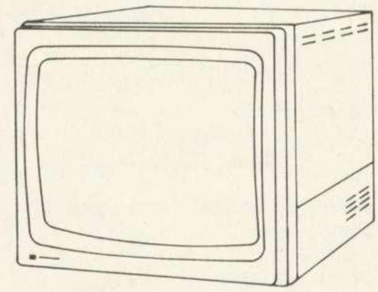
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AU10/4

SOFTWARE CHART

	TITLE	PUBLISHER	PRICE	MICRO	REVIEWED
1 (—)	Frak!	Aardvark	£7.50	B	September '84
2 (2)	Fortress	Amcom	£8.95	B	September '84
3 (3)	Blagger	Alligata	£7.95	B/E	October '84
4 (5)	Twin-Kingdom Valley	Bug-Byte	£9.50	B	
5 (9)	Football Manager	Addictive	£7.95	B	
6 (13)	Chukkie Egg	A&F	£7.95	B/E	September '84
7 (—)	Micro Olympics	Database	£6.95	B	
8 (1)	Aviator	Acornsoft	£14.95 (£17.95)	B	May '84
9 (17)	The Hobbit	Melbourne House	£14.95	B	
10 (8)	737 Flight Simulator	Salamander	£9.95	B/E	December '83
11 (10)	Overdrive	Superior	£7.95	B	September '84
12 (—)	Spitfire	Alligata	£7.95	B	
13 (—)	Felix and the Fruit Monsters	Micro Power	£7.95	B	
14 (—)	Hopper	Acornsoft	£9.95	B/E	August '84
15 (4)	Battletank	Superior	£7.95	B	September '84
16 (20)	Ghouls	Micro Power	£7.95	B/E	June '84
17 (15)	Hunchback	Superior	£7.95 (£11.95)	B	September '84
18 (—)	Countdown to Doom	Acornsoft	£9.95	B/E	
19 (—)	Snowball	Level 9	£9.90	B	
20 (7)	Mr Wimpey	Ocean	£6.90	B	

B = BBC E = Electron Prices in brackets are for disc version

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Quick Thinking (Mirrorsoft)
Brainstorm (Virgin)
Java Star (Shards)
Sea Adventure (Virgin)
Jet-power Jack (Micro Power)
Lords of Time (Level 9)
System 15000 (Ferranti)
Nifty Lifty (Visions)
Cosmic Cruiser (Beau Jolly)
Hulk (Adventure International)
Eagle Empire (Alligata)

Compiled by RAM/Computer

FRAK! has done it. Straight into pole position. Visitors to the AU Exhibition will have seen why it's up there, and what happens when you get to the later stages. Our Editor (who's appalling at games) barely managed to scroll past the first screen, but the real players can get to the end of the trail when the screen is repeated, upside-down!

***Aviator* has stalled after its No 1 entry last month, but Acornsoft's fortunes will no doubt be revived by the newcomer *Elite*, reviewed in this issue.**

Other releases to look out for are Micro Power's *Dune* and a Grand Prix racing game from Software Invasion (complete with bends) to rival Atari's *Pole Position* and Superior's *Overdrive*. Quicksilva also has a racing game under way produced with Atari's blessing.

***Football Manager*'s progress can expect to be given a helpful boot upwards by the start of the new season, probably from Everton fans hoping to repeat their team's success over awe-inspiring Liverpool in the Charity Shield. *Micro Olympics* will no doubt continue going for gold but will have a job overhauling the yo-yoing *Frak!* No doubt the Olympic game will be boycotted by our Eastern-bloc readers because of its commercialism in featuring advertising on background hoardings.**

Adventure fans are making their presence felt with four placings, two of them, *TKV* and *The Hobbit*, showing a lot of staying power in the chart.

Our tip for next month's top match? Still *Frak!* But watch out for *Elite* jumping in and a major campaign from Software Invasion with its *3D Grand Prix*.

TOOLKITS ON TRIAL

Bruce Smith finds firm favourites among five utility ROMs

THE ability of the BBC micro to accept a variety of extra ROM-based software that can be used concurrently with Basic or even replace Basic has always been an important aspect of its design, and it goes some way to compensating for the small amount of user memory available, especially in the high-resolution graphics modes. (With extra hardware, of course, the Electron has similar potential.)

Independent suppliers have been quick to jump onto the bandwagon of ROM-based software (normally termed firmware), producing a variety of programming goodies. As many of you are aware, the choice is confusing. What exactly does the firmware do? Is it as good as the others? If not, which one is the best? And so on.

In an effort to help you through this firmware jungle a comparative review of groups of firmware will be appearing in future issues of *Acorn User*. This month I start the ball rolling with a look at ROMs containing Basic programming aids or utilities. Future issues will focus on machine-code monitors, databases and wordprocessors.

The Jargon

Rom-based software for the Beeb is often called a 'utility'. This word really means an aid to programming, a program that will allow you to perform a certain task with minimum fuss. Consider what would happen if you had a longish program in which you wanted to replace all occurrences of one variable name with another. No problem if the variable has been used only a few times. You simply edit it in using the cursor control and Copy keys. But what if there were ten, 20 or even 30 occurrences of the variable? To edit each one by hand would be laborious. The best answer is a utility program that would do the whole job for you. Enter the name to be replaced, the new name and the utility does the rest! Because of the usefulness of these types of commands a collection of them is generally termed a 'toolbox' or 'toolkit', as they are thought of as supplying a collection of tools for the programmer.

A usable utility

The most obvious way to write a utility program is in Basic, and listing 1 provides an example that lists the values assigned to all the resident integer variables in decimal and hexadecimal. Trouble is, writing a utility in this way has many drawbacks. First, where do you put it? The most obvious way is to incorporate it in the main program as a procedure, as demonstrated in the program. A library of utility procedures could be stored on tape or disc as ASCII files and simply spooled in as required. However, this eats up memory and means that the final program will need editing to remove the utility when it is complete – shades of Catch 22!

An alternative method would be to place the utility in a different part of memory by adjusting the value of PAGE. The program still uses up memory, assuming there's enough to put it there in the first place. To run the program you have to alter PAGE and change it back to its original setting to get back to the main program.

Another approach is to write the utility in machine code. The main disadvantage here is that you need a knowledge of assembler to do this yourself, unless the software is being bought. Machine code is more versatile than Basic and usually much less demanding of memory and so can be placed out of the way in a backwater of memory. The user-defined character space from &C00 to &CFF is a favourite location. Executing machine code doesn't involve the complicated rigmarole of changing PAGE etc. – a simple CALL to the start address will suffice. Machine code also operates much faster than an interpretative language such as Basic.

Listing 2 provides a simple program compactor. Type it in, run it, and save the machine code to tape or disc using:

```
*SAVE "SPACE" C00 +FF C00
```

Using the program simply involves *RUNing it or, if already present, CALL &C00. The effect of the program is to remove all spaces, except those within quotes, from the program at PAGE so that it requires less memory space. This utility needs to be used with care. For example, the line:

```
500 DEFPROCdemo  BYTE%=0
```

is legitimate, but after deleting the space the line will be:

```
500 DEFPROCdemoBYTE%=0
```

which will cause an error at run time. The way around this is to place a colon between the procedural name and the variable, thus:

```
500 DEFPROCdemo : BYTE%=0
```

Similar care should be exercised when using the assembler to differentiate between a label name and the opcode to prevent them from turning into one long label name!

Using machine code in this way has its disadvantages – it still uses up memory. This may not be a problem if only one utility is required, but finding space for two or more useful utilities well out of the way is not easy. Also, once a machine code program has been assembled into a particular area of memory it can normally only be loaded back and used correctly in that same area, unless some fancy coding techniques have been employed to make it relocatable. Thus a program assembled to run in the soft character buffer is not much good if your program makes use of the definable character facility! A way round this would be to assemble code into several areas and load the required one in, but this is

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Bruce Smith's example utilities in Basic and machine code (listings 1 and 2) are on yellow page 112

fiddly and time-consuming, especially for tape users.

Inside track

Home-brewed utilities therefore have their disadvantages – they have to be written, they use up precious memory and they are not always easy to use. The best compromise is to use machine code stored within EPROMs using the sideways ROM facility of the Beeb. The advantages are many. The utilities are always on hand because they form part of the micro itself, and that also makes them 'portable'; you are not dependent on disc drives or cassette recorders to get at them. Virtually all the commands are implemented as commands because the ROM itself contains an interpreter that recognises them. Thus our compacting program, if found in a toolbox, might be executed just by typing *PACK or *CRUNCH. Because ROMs occupy the same area as Basic they are transparent to the user, thanks to some clever electronics, and do not normally require any user memory.

There are disadvantages, of course. For a start, outlay – most items of firmware normally cost at least £22 and they need to be fitted into the machine. A dealer will often do this if you buy from him, but the mail order buyer is on his own.

What's around

Toolbox The only serious item of tape-based utility software I have encountered is BBCSoft's *Toolbox*. This is a neatly packaged book with accompanying cassette of programs. It obviously suffers from all the aforementioned problems and at £21 is not cheap. However, for anyone wishing to learn about the techniques involved in utility programming it is a useful introduction. Twenty-five utilities are provided, 13 of which are written in Basic and 12 in assembler. A good range of programs are provided and these include sorting routines, a variable dump, a REM stripper and program formatter. Each program is discussed in the accompanying text.

It has to be said, however, that EPROM-based software is really a must for the serious utility user.

Addcomm The *Addcomm* from Vine Micros is probably the best value for money out of the toolkits. Although it does not come out on top in table 2, the overall command content is undoubtedly the best. In addition to the 31 Basic programming utilities the EPROM provides some useful enhanced graphics facilities, including circle and ellipse drawing commands, colour fills and commands to scale and rotate your creations.

A simple implementation of Logo graphics is also included providing turtle graphics commands such as PEN, LMOVE, ROTATE, ANGLE and so on.

The commands are implemented not as operating system commands (ie, commands prefixed by asterisk) but instead they are entered directly as they are. This is because the *Addcomm* interpreter traps the errors that Basic would normally throw up and then tries to interpret the command that caused the error as an *Addcomm* command. This is good in theory but it can lead to confusion as it sometimes interprets Basic errors as *Addcomm* errors and displays the wrong error message.

Finally, *Addcomm* offers 40 commands to the user, though I consider only 37 of these usable. The other three allow the user to jump out of loops – naughty! They should be ignored by the user as they are not good programming practice. My plea to Vine Micros would be to delete these computer nasties from the instruction set and replace them with better error-handling.

Caretaker I'm a little disappointed with *Caretaker*. Over the past couple of years Computer Concepts has produced some of the best firmware for the BBC micro, but *Caretaker* falls some way short of the company's high standards. Of its 18 commands, I consider three to be space-fillers, although they are useful sometimes. CURSOR allows the cursor to be turned on and off, while TABSTOPS and NOTAB allow the user to determine the new position of the cursor on the screen.

What disappoints is that it is rather run-of-the-mill, and shows none of the originality we've come to expect from CC. Useful enhancements, however, are those of single key command entry, emulating the Electron, as is the ability to save specified sections of program such as important procedures. *Caretaker* also scores on its EXCHANGE facility, which allows a good degree of control in selecting global or selective search and replace.

Toolkit Beebugsoft's *Toolkit* scores well in the five standard ratings section of table 2. The variable dump commands are extensive and include listing of procedure names and arrays in addition to integer and real variables. The enhanced line editor is useful, allowing program scrolling in any direction and listing of any erroneous line, highlighting the error at run time.

A couple of commands seem somewhat dubious, however. The ability to be able to perform OLD within a program would be needed on very few occasions, and I can think of no occasion when it has been necessary to perform NEW from within a program.

Toolstar This is not essentially a Basic toolkit but a general utilities aid, as it includes machine code and disc utili-

ITEM	ADDCOMM	CARETAKER	TOOLKIT	TOOLSTAR	U-TOOLS
PRICE	*£28*	*£33.35*	*£27.00*	*£34.00*	*£26.95*
No. Basic commands	31	18	26	8	26
Total No. commands	40	18	26	22	26
Bad program cure	●	●	●	●	●
Compact	●	●			●
Error-handling			●		●
Find	●		●	●	●
FKeys lister	●			●	●
Format listings	●				
Global search/Replace	●	●	●	●	●
Graphics Enhancement	●				
Help page	●	●	●	●	●
Insert program lines		●	●		
PACK	●	●	●		●
Program status	●	●	●		●
Renumber		●	●	●	
ROM command identity	●		●	●	
Save/Load function keys		●			
Save part program		●			
Screen dump					●
Single key commands		●			
Shift program		●	●		●
Turn off ROM	●				
Variable dumps	●	●	●		●
Verify			●		

Table 1. Facilities at your command

159

ties. As table 1 shows, only eight of its 22 commands are Basic-orientated and this should be borne in mind when it comes to your decision. In essence, *Toolstar* is suited to the advanced programmer who dabbles in machine code and Basic and uses discs.

The global search and replace facility is a good implementation and the tookit's built-in software allows you to add your own RAM-based commands. A very interesting feature.

The *Toolstar* manual is excellent – by far the best I have seen produced for an item of commercial software; indeed it is much better than many computer user guides. Its 156 spiral bound pages are colour-coded, and copious use of examples makes it a joy to read.

U-Tools The *U-Tools* box offers a good, steady variety of utilities. One of the more interesting features is a command that will not only save a program but also lock it so that it can *RUN, though it is a shame that it can be used efficiently only with machine code programs. A variety of program-crunching commands are on offer, plus an error-trapping wedge that lists an erroneous line before printing the error message.

	ADDCOMM	CARETAKER	TOOLKIT	TOOLSTAR	U-TOOLS
Ease of use	8	7	7	7	7
Range of utilities	8	7	6	5	7
Documentation	8	5	5	10	5
Error messages	5	6	9	6	6
Five standard utilities ratings					
Bad program core	7	7	8	8	7
FIND string	8	N/A*(5)	9	7	8
Global search & replace	8	9	8	9	7
Program compactor	9	9	7	N/A	9
Variable dumps	7	8	10	N/A	8
TOTAL	68	63	69	52	64

N/A = Not available.

**FIND not directly available but can be implemented using global search and replace facility and specifying same search and replace strings.*

Table 2. How they score on a scale of 1 to 10

U-Tools is the only toolbox to provide an intelligent screen dump of any of the graphics modes to an Epson or Epson-compatible printer such as Star. The dump provided is large – 23 × 16.5cm – and it is produced *down* the paper.

Which one?

Before choosing which Basic toolbox you want to buy it is worth making out a list of items that you feel it should contain – in other words, the commands that would be most useful to you.

My own preference is the *Addcomm*, followed by *Toolkit*, finances allowing. From table 1 it would seem that the best combination would be *Addcomm* and *Caretaker*, as they cover the entire range of utilities. However, these two ROMs seem to be incompatible as some *Addcomm* commands will not function with *Caretaker* present.

At the end of the day, however, it should be a personal choice.

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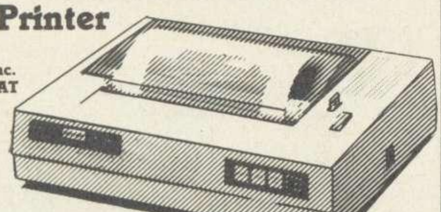


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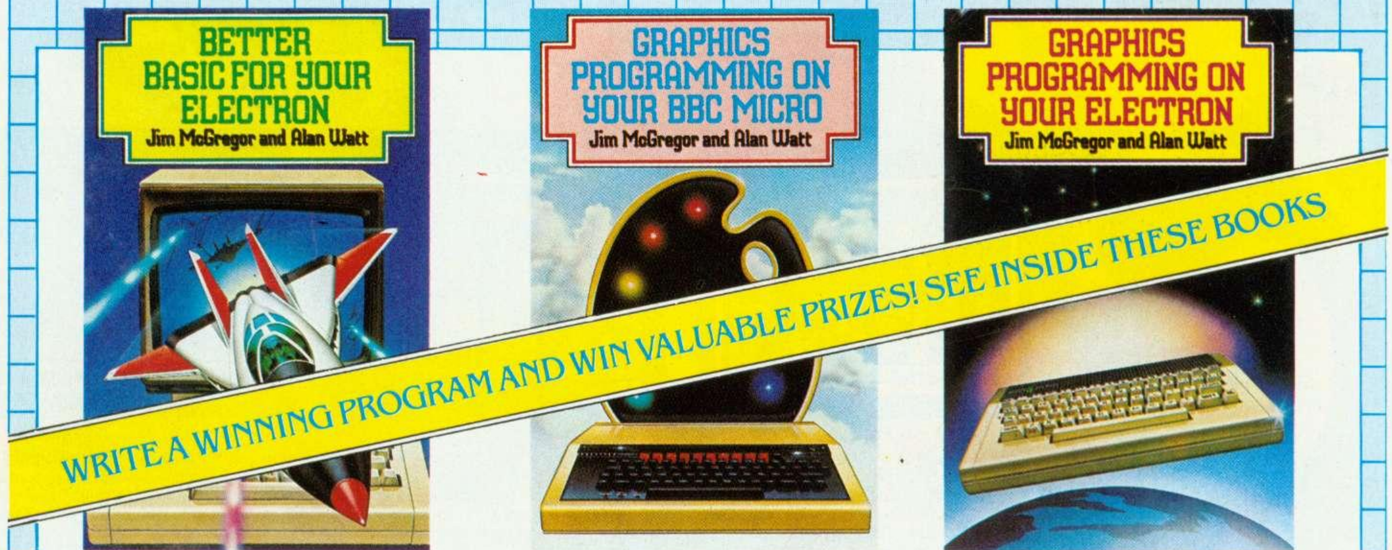
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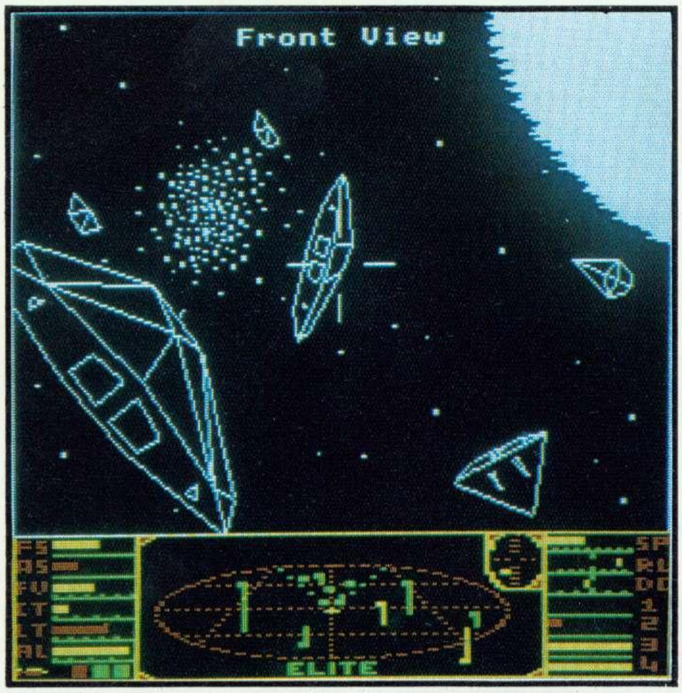
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STAR STATUS

Tony Quinn goes boldly to Cambridge on an Elite mission

'Elite', Acornsoft, BBC B, £14.95 (disc £17.95), Electron, £14.95



SPACE is the final frontier as far as Acornsoft is concerned, and the company reckons to have cracked it with the new release, *Elite*.

This game has been the subject of the biggest security operation the company has ever mounted, to ensure no details leaked out before the launch this month. It is still so secret that even I don't have a copy!

Acornsoft spirited half a dozen journalists up to Cambridge and locked them in a room to review the game. So, this is not a full review, but my impressions after bashing away for a couple of hours. However, having written my escape clause, I must say *Elite* looks superb.

Imagine a subtle blending of *Aviator* and *Starship Command*, a sprinkling of the *Star Wars* films, shaken with a trading adventure, served up with some secret ingredients and you have *Elite*.

It sounds ambitious but it's all there, wrapped in a short science fiction novel that sets the scene, a substantial training manual, a poster identifying the foes and friends you are likely to encounter and a postcard giving entry to the competitions that Acornsoft plans to base around the game. Not bad for £15. Plus, the disc is filled out with some special bits and pieces. You'll have to play to find out what they are – I've no idea!

The idea of the game is to start off with a simple space ship and build it and your reputation up to 'Elite' status.

Budding Han Solo's start the game with a sparsely equipped space ship and a small supply of money. The ship is docked in a station orbiting a planet. Pressing various function keys gives information on the planet and enables the raw pilot to buy various goods from food and drink to drugs. Having stocked up, the ship is launched into space and the course set for another planet.

Once a destination has been fixed, the ship goes into hyperspace and after a few seconds emerges near the chosen planet. Then it's a dash to reach the orbiting space station before the pirates pounce. The ship has then to be docked by plotting a flightpath along a line leading from the centre of the planet into the station. The entrance is a slit, and the station is rotating, so the ship has to match rotation, otherwise it just won't fit.

Your wares can then be traded, preferably for a profit. Any credits earned can be used to fund the next flight and buy better equipment for the ship.

As you trade and equip the ship until it's bristling with weaponry and everything money can buy, it becomes tempting to play naughty. Illicit cargoes such as slaves and drugs can be bought. You could be in trouble with the law but it's a good way of making a fast buck. Then you can attack space stations for the fun of it, and even try trading with one of the deadlier planets. The risks are high, but so are the profits.

That's the theory, now for the action. The colour screen shot shows a typical view of space, except there are a lot of nasties around. (This shot was specially set up and you are unlikely to meet so many different types of enemy at once.) Views to the front, rear and both side of the ship can be called up.

Instruments at the bottom of the screen give compass, a three-dimensional map of space and other ships within range, and the status of energy banks and weaponry.

Controlling the ship takes some getting used to, as it's difficult to know where you are and which way to go, especially when someone's shooting at you. The keys are a bit awkward: there are a lot of them, and some are in strange places.

Elite apparently uses up just about every spare byte there is in the Beeb's memory (and some it shouldn't). The graphics impressed even the Cambridge gurus when *Elite*'s two student authors showed them off. Circles and elipses are drawn in full in real time with hidden line removal. The 3D effects are astounding, and the suns have to be seen to be believed. Screen graphics modes 4 and 5 are used at the same time to give accurate plotting and colour for the display. Screen width is reduced to speed up plotting and save memory. The reason for the strange keys? Simply because they are next to each other in the operating system's look-up table.

How much work the BBC is doing when plotting the suns and planets is shown as you fly towards them. If you look straight ahead, the game is slowed down! To get there quicker look to the side or behind.

So how do we sum this one up? Well, it's the best game of its type and all *Meteors/Starship Command/Defender/Aviator* freaks will love it. Players who like adventuring might well be hooked by the trading aspects. And then on the disc version there are these things called 'missions' where a task is set. Finally, there's the unknown: no-one has yet reached the ultimate Elite status, and there's even a ship out there that no-one has yet come across. Apparently it eats spaceships, so watch out.

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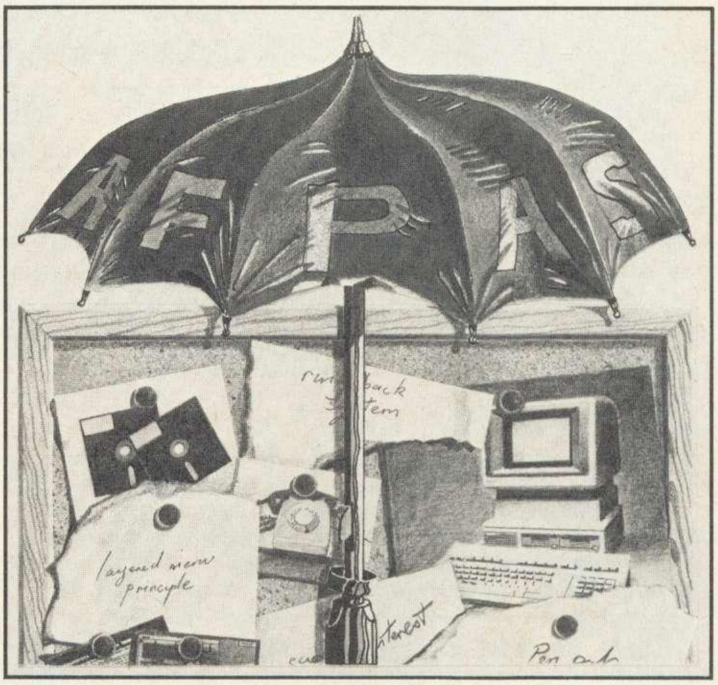
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Access

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SPREAD THE MESSAGE

Bulletin boards offer real person-to-person contact, says Jeff Ashurst. Why not join?



BULLETIN boards have been set up by enthusiasts motivated by an interest in microcomputer communications, rather than by commercial gain. True, some BBs are associated with, or sponsored by, small micro businesses, but this aspect is secondary to their main function of providing a way to exchange information. With this aim, the Association of Free Public Access Systems (AFPAS) was founded, and each system operator (SYSOP), with one exception at the time of writing, is a member, under the chairmanship of Fred Brown, SYSOP of Forum 80 in Hull. Incidentally, this was the first microcomputer bulletin board set up in Britain – just look what he started!

Under the umbrella of AFPAS, BB operators have adopted as their standard the V21 transmission protocol of the CCITT (Consultative Committee for International Telegraph and Telephone), which specifies receive and send rates of 300 bits/second, or 300 baud.

Let's assume you're sitting comfortably with your micro, telephone, a V21 modem and some suitable software. You are free to make whatever use you choose of the bulletin boards, from electronic pen pals to serious information exchange. But where are these boards? And which are the best?

Well, the table on page 169 should answer most of your questions. It lists bulletin board systems with their telephone numbers and operating hours and brief comments regarding special interest groups (SIGs) catered for and other points of note. You will notice a few boards with the comment 'ring-back system'. To access these, call the number, allow the telephone to ring once (ie one double ring), replace the receiver and call again. On the recall, the modem will respond with its high-pitched tone. Then, as with the others, switch your modem to 'on line' or 'data' and replace the handset fairly quickly.

As to what makes a 'good' bulletin board, the answer must be subjective to a degree, but I suggest the following criteria:

- BBC-related information and software.
- Other special interest material.
- On line 24 hours daily.
- Within local call range of your phone.

The last condition cannot always be fulfilled, but should become more and more possible as BBs proliferate. The systems listed are sprinkled from Cumbria to Southampton. I've never heard of any in Scotland, Ireland or Wales, but it's difficult to believe there are none. I've also included a Swedish board specialising in BBC matters.

Systems are coming on line all the time. If anyone knows of, or operates, a board that does not appear in the table, please let me know, either via *Acorn User* or by leaving a message on Liverpool Mailbox.

Roughly half the boards are on line 24 hours per day. The others operate in specific time bands on particular days, which can be restrictive. It is, however, understandable that system operators (and their families) need their telephone line for other uses. Clearly the best solution for BBs is to install a second, dedicated phone line. Even with 24-hour access, however, the better boards are more often than not engaged, with some SYSOPs reporting around 50 calls on a typical day. You must expect a sore dialling finger!

After logging on with your name and home town, you will find that bulletin boards operate invariably on a 'layered menu' principle. The main menu will allow you to read or enter messages of general interest, but it will also offer access to SIGs, software for downloading and often features such as news, prices of peripherals, electronic mail and information about the system. Electronic mail consists of messages addressed to individuals by name, and is readable only by the recipient (although you can't prevent the SYSOP from having a look).

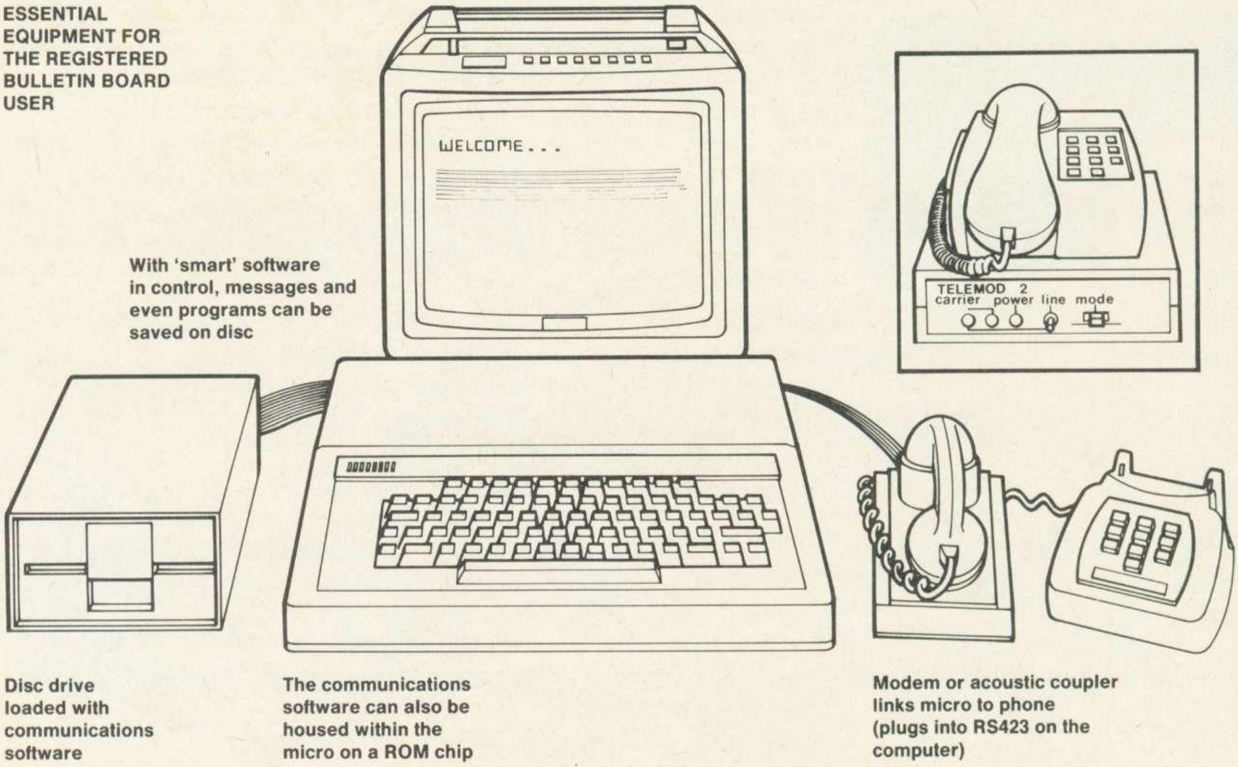
Software

Communication – questions and answers, information, mutual help – can be achieved using so-called 'dumb terminal' software, that is to say a program which simply outputs characters from your keyboard and displays incoming characters on the screen. Such a routine, by Paul Beverley, was published in *Acorn User* of November 1982. I have also used 'VDUPROG' from Mike James' book *The BBC Micro – An Expert Guide*.

To download the free software available, however, you will require a 'smart' program. The best of these are available as communications ROMs, and are advertised regularly. A good example is Pace's *Commstar*. Using sophisticated firmware of this type it is possible to select the receive and send rates, the word length and parity (see July's issue), and to both upload and download files reliably. A suitable modem enables access to bulletin

INTERESTING BULLETIN BOARDS FOR BBC USERS

NAME	NUMBER	HOURS	COMMENTS
BASUG	(0742) 667983	24 hours daily	Apple user group BB. Ring-back system
BUG	010 468 463 528		Swedish-based English language board for BBC users. (Watch the bills on this one!)
CABB	01-631 3076	24 hours daily	Acorn, Commodore and Sinclair SIGs
CBBS Cumbria	(06992) 314	Daily 1800-2200	Ring-back system. Multi-standard: V21, V23 and Bell 103. Downloading and CP/M SIG
CBBS London	01-399 2136	Sun 1700-2200	
CBBS Surrey	(04862) 25174	24 hours daily	Temporarily off line after lightning strike
CBBS SW	(0626) 890014	24 hours daily	User friendly CBBS board. Popular – usually engaged
Centbull	01-606 4194	24 hours daily	Wednesday 1200/75 protocol. Sirius and Tandy SIGs
Distel	01-679 1888	24 hours daily	Display Electronics board. Very user friendly. News and Product information, including BBC interest section
Estelle	(0279) 443511	Office hours only	STC Electronic Services BB. Also other protocols: ring (0279) 441188 for V22 (1200/1200) or (0279) 441222 for V23 (1200/75)
Forum 80 Hull	(0482) 859169	Mon-Fri 1900-2230; Sat/Sun 1300-2230. Daily 0000-0700	US Bell 103 standard. The first British BB
Forum 80 London	01-902 2546	Evenings and weekends	Telephone and ask for Forum 80
HAM-NET	(0482) 497150		New Hull-based BB specialising in information exchange for radio amateurs
Liverpool Mailbox	051-428 8924	24 hours daily	BBC SIG and download section. Other SIGs include Microwave for radio amateurs. Britain's first 24-hour BB
Mailbox 80 W Midlands	(0384) 635336	1730-0830 Also all day Sun	BBC SIG: Download planned on receipt of sufficient software
Manchester BB	061-427 3711	Sun-Thurs 2230-0000; Fri 2330-0200; Sat 2230-0200	BB under development running on BBC
Maptel	(0702) 552941	Out of office hours	Maplin Electronics board: product information
Microweb	061-456 4157	24 hours daily	BB dedicated to Acorn/BBC matters
NBBBS	(0827) 288810	24 hours daily	N Birmingham. Ring-back system
Rewtel	(0277) 232628		Run by *Radio and Electronics World* magazine
Southern BBS	(0243) 511077	Daily 2000-0200	Helpful general interest board
Stoke ITEC	(0782) 265078		CP/M BB, ie when logged on, CP/M commands can be entered directly
TBBS Blandford	(0258) 54494	24 hours daily	BB SIG. Hopes to have full menu of BBC related items at future date
TBBS London	01-348 9400	24 hours daily	BBC SIG and download section
TBBS Nottingham	(0602) 289783	See comments	To start in near future, with V21 (300/300) and V23 (1200/75) protocols and Prestel-type graphics
TBBS Southampton	(0703) 437200	24 hours daily	



boards, Prestel or even allows your micro to emulate a specific mainframe terminal. Smart software also allows you to compose messages in advance, dial the BB number, upload to the board, download any messages and log off. Messages can then be studied at leisure, or saved to tape or disc, without running up a phone bill.

Once you've logged on, selecting 'SIG' from the main menu will produce a sub-menu of special interest groups, such as BBC, Commodore, Tandy, etc. This is where you will find questions, answers and information on the specific topic selected. BBC owners seem to be quite widely catered for, but remember, the success of a SIG, and of the board in general, depends upon the input. So write. Ask a question. Leave a message. Questions produce answers which, in turn, generate further comments. The more you put in, the more you get out.

Hardware

Looking at modems, several manufacturers are now marketing products built around the AM7910 chip, which offer the facility of switching between not only CCITT V21 (300/300) and V23 (1200/75) standards but also the US Bell 103 standard. The Bell standard specifies 300 bits/second transmission but at different frequencies to V21. These switchable modems are really superior to single standard devices, and obviate the need to place oneself in one camp or the other, bulletin boards or Prestel, when buying. As yet there is a price premium, but I expect costs to fall.

The future

To date, most of the successful software packages to run bulletin board systems, including TBBS, CBBS and Forum 80, have been written for Tandy machines. Historically, this is because the BB idea was imported from the US, and the Tandy micros have proved to be popular American workhorses.

Now, however, people are developing BB programs to run on the Beeb, and some of these should find their way to the market place, either as software offerings or software/hardware packages. Torch is already moving in this direction with a modem and software combination giving access to Prestel (August issue).

The last hurdles are now falling, and the field should soon be wide open, in terms of choice, to individuals and organisations who want to operate a BBC-based host system. Incidentally, further information on AFPAS can be obtained from Fred Brown at 421 Endike Lane, Hull HU6 8AG – but *please* don't forget a sae.

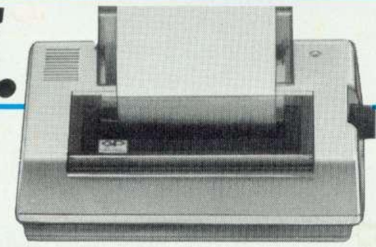
Under the auspices of the government's Micro-electronics Education Programme (MEP), consideration is being given to a BB system for schools – Joe Telford, in July's issue, mentioned CECCTEL, the experimental service for schools in Cleveland. This system is hosted by a BBC micro.

The concept of a board with a specific aim gives, I think, a pointer to the way the bulletin board phenomenon will develop, ie with an increasing amount of specialisation. At present we have two dozen boards in the UK, all broadly aimed at the serious hobbyist. Given many times that number, I expect to see some systems carrying information relating to specific interest groups. Probably the first example of this is the new HAM-NET board in Hull (see table). In the US, with several thousand systems, there is even a bulletin board carrying details and telephone numbers of bulletin boards!

In conclusion, I must say to new and prospective modem owners that I hope you find as much satisfaction in communications as I do. Old hands will know what I'm talking about already. Bulletin boards occupy a special place in this expanding dimension of microcomputing. Yes, we need viewdata for share prices, flight times, weather forecasts and the rest, but to exchange information with real people is a much more rewarding idea.

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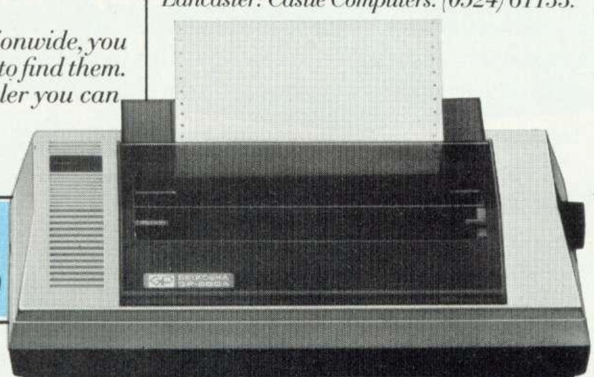
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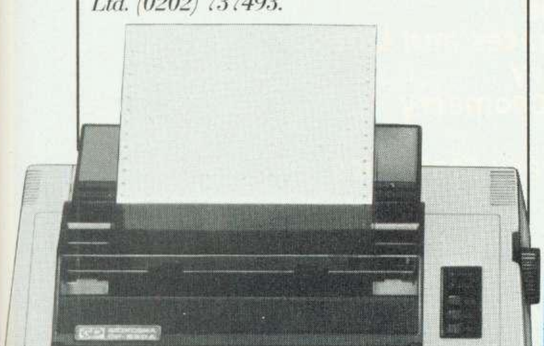
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ROUTE OF ALL EVIL

'Blagger', Alligata Software, 178 West Street, Sheffield S1 4ET, £7.95

FOR too long the air at computer clubs has been filled with the insane rantings of the owners of certain other (48k) micros about the Beeb's incapacity to play M---c M---r and J-t S-t W---y. Well, now we have at least a first layer of defence in the form of *Blagger*.

The scene is set with a red-haired robber, a 'blagger', working his way through a number of different shops, collecting five keys in each (left in increasingly awkward corners) and taking them to open a safe. At the end of 20 screens – if he ever gets that far – he finally escapes.

The game uses the top half of a mode



2 screen to show the shop interiors, which contain an assortment of platforms, walls, conveyors, and disappearing ledges. Each screen is a complex arrangement of these features and a good deal of thought is required to work out a successful route. At each level, a number of well-animated sprites parade up and down or to and fro. These are fatal to the touch, as are the bushes which are dotted around the place. The bottom half of the screen shows your score, level, number of men etc.

The sound effects are fairly basic and can't be turned off, but they didn't prove too grating during play.

A rather more annoying oversight is the lack of an option to start the game at any level. I suppose this should mean that the game will last longer before being solved, but it is aggravating to have to complete the easy levels on each attempt before getting to the one you're working on. A practice mode would be very useful.

Nevertheless, Blagger is an entertaining game with smoothly animated graphics and plenty of variety. I confess to not having proceeded very far, but then there's no history of blagging in the family and I've been trying to go straight, honest guv! **Simon Williams**

JOCKEYING FOR POSITION

'Horse Race', Dynabyte Software, BBC B (32k) and Electron, £6.95

YOU are given £1,000 which you must bet on up to six horses to try to bust the bookies. The computer gives you named horses and their odds, and you may put up to £999 on each one. You then see the six horses raced across the screen.

The graphics in *Horse Race* are superb – the animals are drawn in detail and their movement depicted correctly. You can see their tails move, and all the detail on the jockeys. Two stands are displayed and a commentary board shows which horses have been bet on and which one is in the lead. The game displays people near the ropes waving, flags flapping on the stands, and a very detailed camera car driving alongside the runners.

The sound too is superb. It plays a different tune while loading, before betting, and before and after each race. You can even hear the hooves of the horses and the thud of jockeys falling off.

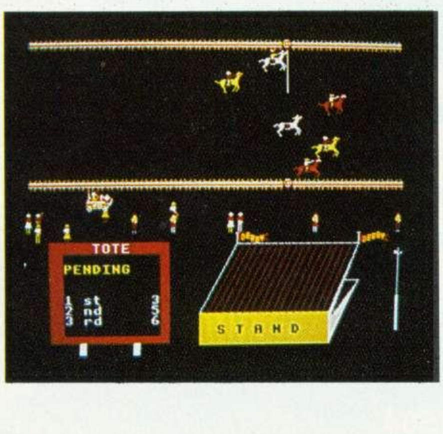
You select a game for between one and six players, and the number of races to be run. There's no sound on or off option, but surely nobody would want to turn off such good sound effects.

Horse Race is user-friendly and supplied with excellent instructions.

It's repetitive in that it's the same thing every race, only the names and odds change, and it's also boring playing by yourself because there's no skill to it: you place your bet, sit back and the computer does the rest.

When playing with many people, though, it can become quite exciting.

Ian Brettell



HUSTLER AT THE KEYBOARD

'Pool', Dynabyte Software, BBC B (32k) and Electron, £7.95

THIS version follows the same rules as real pool, except that there are only three balls of each type. There are versions for the BBC and the Electron and they differ in that the latter doesn't play a tune while loading and the music at the start is played on only one channel instead of the Beeb's three. The Electron version also lacks the extra effects obtained in mode 7.

The sound is good on the Beeb. As well as the 'loading' tune, the computer plays *The Entertainer* at the start of the game and at the completion of each frame.

During play, however, sound is scarce, just short beeps when balls collide and two low beeps for a foul shot. It would have been nice to have an effect for potting, and perhaps a tune playing in the background.

The graphics are reasonable. There are eight large balls on the table: one



cue ball, one black, three red and three outlined red balls, which move very smoothly.

You are offered the options of sound on or off and the number of frames to be played. It would have been an advantage to have a joystick option as well.

The control of *Pool* is easy and responsive. Each player has four direction keys and a shoot key. The length of the cue determines the strength of the shot.

Would it be asking too much to have a topspin and backspin option as well as the ordinary shot included?

Overall, *Pool* is a good game, with acceptable graphics and good sound effects (apart from during play), and it is supplied with excellent instructions. A nice feature is that it displays what you did wrong, eg, 'White ball down'. A drawback is that for people using TVs the red outlined balls and the cue don't show up on the green table. **Ian Brettell**

A World Of Information

Available to you with Nightingale, the new multi-function modem from Pace.



Nightingale is by far the most versatile modem available, at the price, for either home or business use. It offers Prestel/Viewdata baud rates (1200/75 & 75/1200) alongside 300/300 baud full duplex for communication between the BBC and other computers, including bulletin boards.

Nightingale will operate at both European and Bell frequencies for compatibility with CCITT and American systems.

The state-of-the-art modem chip technology employed in Nightingale requires minimal support circuitry resulting in low power consumption, low cost, high quality and extreme reliability.

Nightingale being 'hard wired' is not subject to the noise interference errors common to outdated acoustically coupled devices. In addition Nightingale features a simple self test facility for easy installation.

Nightingale utilises a fully buffered RS 423/232 serial interface and is supplied complete with a lead suitable for connection to the BBC micro, other leads are available on request.

However, in order to use such a versatile modem to its fullest potential, you will require equally sophisticated software. This is where Pace can offer you a total solution — Commstar, unquestionably the most comprehensive communications software available for the BBC.

Supplied on Eprom, Commstar is instantly accessible, simple to use and extremely flexible. Just look at the possibilities:- access Prestel, Micronet, Viewfax, Homelink and Telecom Gold, rummage through bulletin boards and chat to literally thousands of other computer users, but there's more. Commstar can be used to emulate specific terminal types such as VT 100 by means of a configuration disc, thus providing the opportunity to use the BBC as an inexpensive work station for a main frame or mini-computer.

The complete Nightingale/Commstar package for the BBC micro including the modem, cabling and the Commstar Eprom and manual is just £139 plus V.A.T. Nightingale is available separately for the BBC and other computers at £119 plus V.A.T. and Commstar is £29.57 plus V.A.T. Further details are available, please telephone or write for comprehensive fact sheets.

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This modem incorporates the very latest in communication technology and is therefore not yet B.A.B.T. approved.

BARCLAYCARD VISA

LAYING THE FOUNDATIONS

'Chickaroo' by John Cassar, Screenplay, BBC B, £7.95

THIS is an educational game for up to four players, designed to improve a child's word recognition.

A word is displayed at the top of the screen with one letter missing. A chicken then hops along the screen laying six eggs, which begin to move about. The child must shoot an egg, which reveals a letter. If the child thinks the letter fits into the gap in the incomplete word he presses return. Otherwise he continues shooting.

If the child gets the letter correct, a small bird flies up and takes the letter down.

Chickaroo comes with two files, each containing 50 words, and a parent or teacher may enter up to 50 of his/her own words, which may be saved.



The graphics are reasonable and do their job (they don't need to be too elaborate) and are smooth, though for some reason the small bird is flickery.

Some kind of sound effect is to be heard all the time except during the instruction session at the beginning: when the eggs are moving, on reaching 200 points, firing, successfully shooting an egg, little bird flying, Chickaroo hopping, and getting an answer right and wrong.

Up to four players can play, and you are allowed to load and save files. The game is controlled from three keys and I found they were occasionally slow to respond. A joystick option would have helped the younger child, who might well get the keys mixed up.

Chickaroo is a good educational program. It's a bit like space invaders, making the learning process fun. Good graphics and sound add to its quality.

Ian Brettell

FIVE-STAR TRADING POST

'Star Trader', First Byte Software, BBC (32k), £7.95

THE object of *Star Trader* is for you, as commander of an expedition starship, to explore the five star systems and their planets, trade with the inhabitants, and mine the area. If any planet is inhabited, you must persuade the population to join the Empire.

You must seek out the Ultimate Computer, as your planet needs its resources.

A corner of the screen displays the five 'single character' star systems. You must move your 'block' or space ship over the system, then press 'V' for visit. The screen flashes, and you then have the system's many planets to orbit, explore, mine, and do trade with. These are just different-sized dots.

The rest of the screen is divided into three sections. One of these shows your status, fuel, time, food, water and air; another is your inventory, showing your trade; and the third displays details of the planet you're currently orbiting, its temperature, atmosphere, population type, attitude, water, food, fuel and minerals.



Sound is scarce. Beeps accompany the movement of your ship, and there's an effect for visiting and leaving planets.

Star Trader seems similar to *Startrek* and *Galaxy*. It's slow and boring with hardly any variation – the process is the same for each planet.

You may load and save games, and you are given very clear instructions, demonstrating each part of the display.

Ian Brettell

FLUSHED WITH SUCCESS

'Corporate Climber', Dynabyte Software, BBC and Electron, £7.95

IN THIS game you're an office tea boy whose aim in life is to rise through power and become company president, having a key to the washroom. On your way you have to watch out for taxmen in the lifts, and make sure the strain and stress doesn't raise your blood pressure too high, resulting in a heart attack.

Various objects are scattered about on your way.

You are represented as a little man with a cap, and it looks as though he is carrying a tray. You can see the office building, marked off in stages, with a toilet at the top, marked vacant.

There are lifts going up and down, with taxmen aboard – and they kill you! Bonus objects include telephones, cups of tea, acorns, keys, chairs and suitcases, all shown in good detail, with colour well-used. The lifts move very quickly and can sometimes be a bit flickery.

A pleasant tune plays all through the game, and the only other sound effect is a ping, for when you rise up a level, and for collecting objects. There's an option for sound on or off, three levels of difficulty, but no joystick option.

Corporate Climber is a good, original game, with good sound and visuals, and it comes with adequate instructions.

I reviewed an Electron version on a BBC and found it fast and a little too hard. The speed probably accounts for the flickering graphics. On an Electron the game is much slower and I cleared the first screen first time, whereas I've never managed this on a BBC.

Ian Brettell

More games reviews on pages 179 and 182

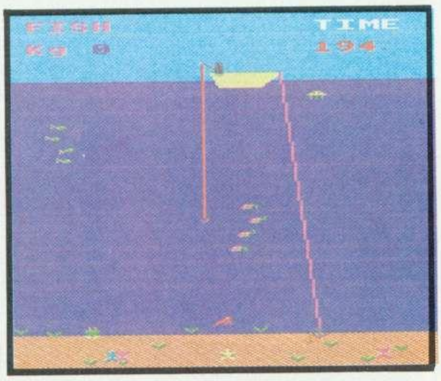
SEVENTH HEAVEN

'SUPER-7' compendium, DACC, BBC, £8.95

SEVEN games on one tape? They can't be any good!

That was my initial reaction. But they *can* be good. None of them is of the standard of the real bestsellers, but they are good value if you want a change, and two of them seem pretty original.

I had never seen anything quite like *Fire Chief*, in which you rescue people from tall buildings, and put out fires. The aim is to deal with as many fires as you can without running out of fuel or water. A really good game requiring



speed of thought and reaction, and forward planning.

Creatures of the Deep has you sitting in a boat fishing. Simple controls allow you only to raise and lower your line. The aim is to catch fish by reeling them into the boat. You must avoid the various monsters, or if you catch them by mistake you must remove them from your line by the appropriate method. You fish against the clock, and your catch is given in kilograms.

The other games are less original but still attractive, all with good graphics. They are:

Space Rescue – a two-screen game, with an easy first screen, and then a second screen in which you have to pick up men from the planet surface and return them to the spacecraft.

Bouncer – a bat 'n' ball game with a twist which rendered me totally incapable of hitting the ball!

Chopper Chase – a nice little anti-tank warfare game.

Space Pilot Test – a *Defender*-type game but without a corridor. All the action takes place on a single screen.

Guns of Navarone – a gunnery simulation game, needing judgment of elevation and power to hit the attacking helicopters and destroyers.

The picture is of *Creatures of the Deep* in action. The tape transferred to disc with little trouble, as none of the games has voracious memory requirements. I ran them all successfully at PAGE = &1200, needing no shifting.

George Hill

INSECT INFESTATION

'Bugblaster', Alligata Software, BBC and Electron, £7.95

A CENTIPEDE comes down from the top of the screen, and you play the title role in *Bugblaster* – you must shoot it. There are mushrooms scattered around, which get in the way of both of you and the centipede. There are bonuses for shooting Brian, the mushroom-poisoning scorpion, and spiders. You are a small base at the bottom of the screen that moves left, right and about five lines up and down.

Bugblaster uses four direction keys and a shoot key, and includes a hall of fame.

The objects and characters are well drawn, showing good detail, and colour is well used. All mobile objects move smoothly and without flicker.

There are sound effects for the centipede's movement, firing, spiders and snails appearing, and for a bonus man every 10,000 points, but a tune before



and during play might have brightened things up.

Sadly, there are no options in *Bugblaster*. It is the sort of game that would be nice to play with a joystick, and Alligata could have added a difficulty level and a sound on or off option.

Good sound and graphics make *Bugblaster* a fair game, though it seems to be a plushed-up version of *Space Invaders* set in different surroundings. It becomes boring, as the action is the same on each screen – only the colours change and the speed increases. More variation in screens and attention to detail in game options would have made it very good.

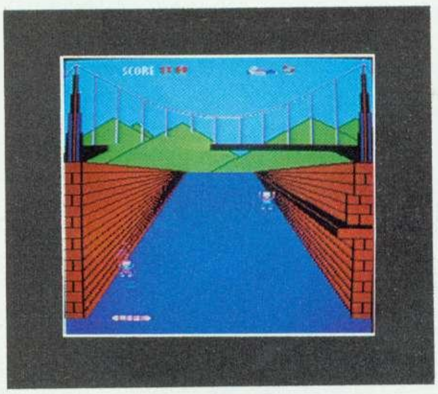
Ian Brettell

BOUNCING TO SAFETY

'Lemming Syndrome', Dynabyte Software, BBC (32k) and Electron, £7.95

MAD Marco is on the rampage and has blown up the bridge to the mainland. The people are panicking, jumping into the shark-infested waters rather than facing him. You are lifeboat Lennie, and using your raft, must bounce the people to the other side, avoiding sharks and Mad Marco with his dynamite.

The scenery in *Lemming Syndrome*



is well drawn, though motionless, and includes a blown-up bridge over a river, and hills. The movable objects – your lifeboat, people, sharks, and dynamite – travel smoothly.

You can alter the speed of the game and thus degree of difficulty, have sound on or off, and you can choose to control your raft in proportional or absolute mode. In proportional mode the raft moves left or right a pixel at a time; in absolute there are three set positions to which the raft may move – left, middle and right. Using the absolute method is much easier. The only option *Lemming Syndrome* lacks is a joystick.

Lemming Syndrome has excellent graphics, good sound, is very flexible with its many options, and is supplied with good instructions. Underneath the fancy graphics, and a well thought out background around Mad Marco blowing up the bridge, *Lemming Syndrome* is just a variation on the *Breakout* theme. It's the same all the way through and, though quite a testing game, it becomes boring.

Ian Brettell

Introducing BEEBUGSOFT

Until recently a very special range of applications and utility packages for the BBC micro has been unavailable to the general public.

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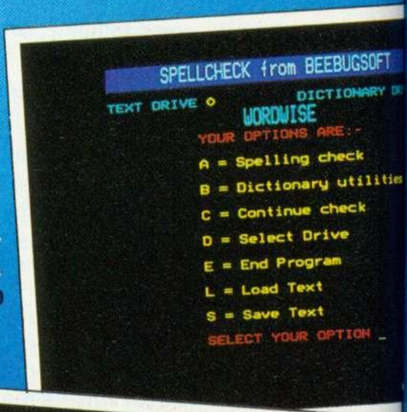
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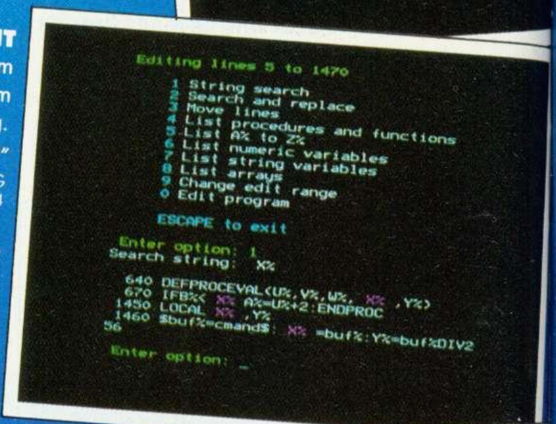
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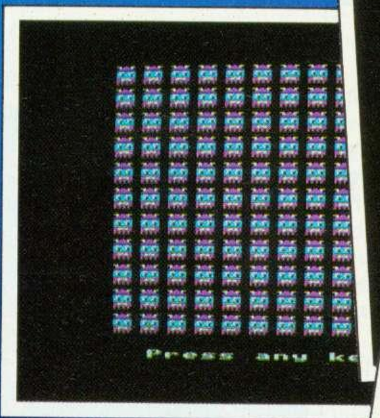
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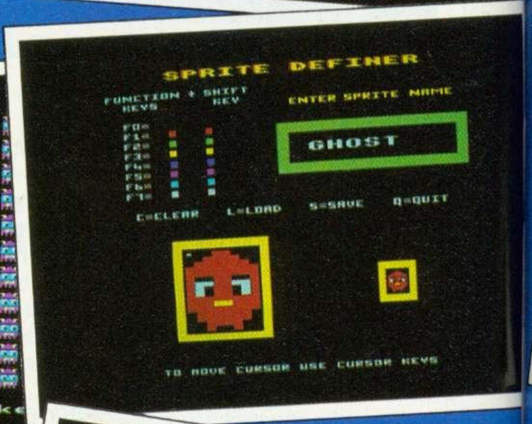
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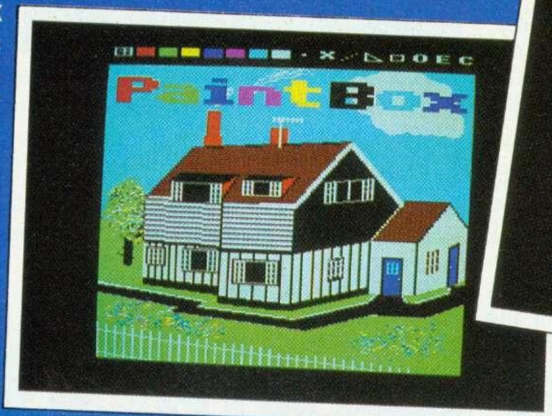
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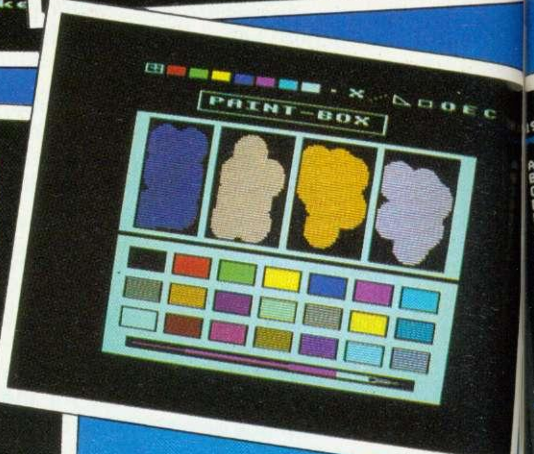
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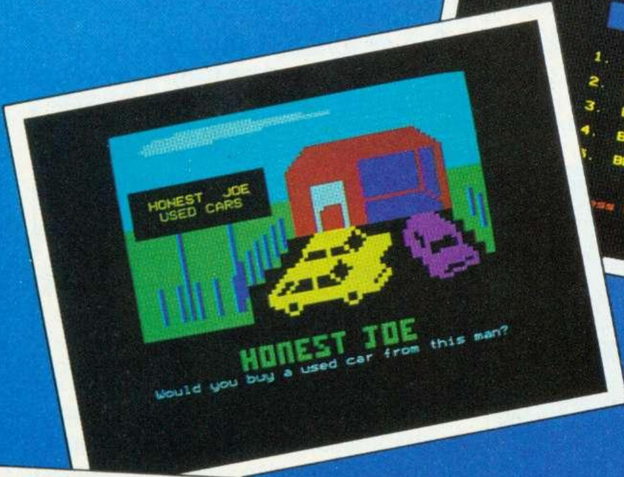
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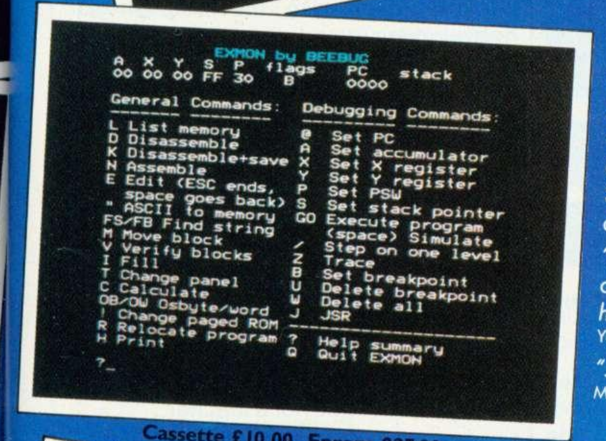


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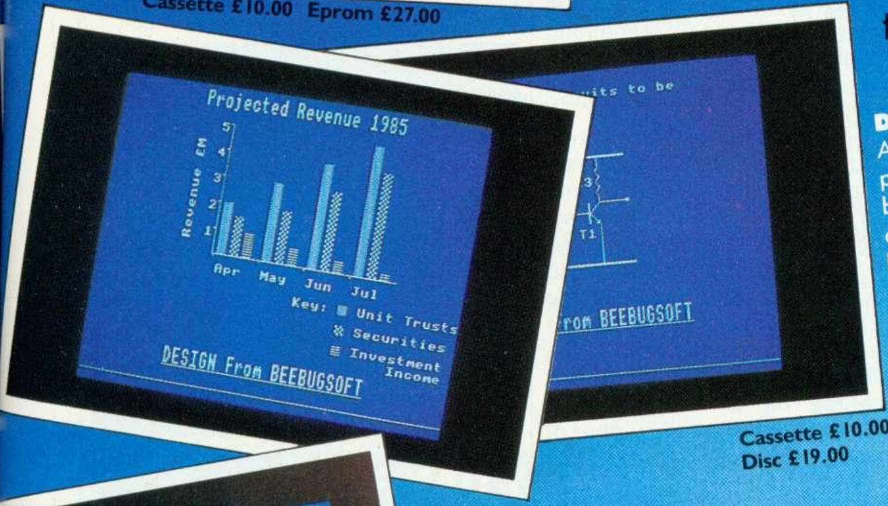


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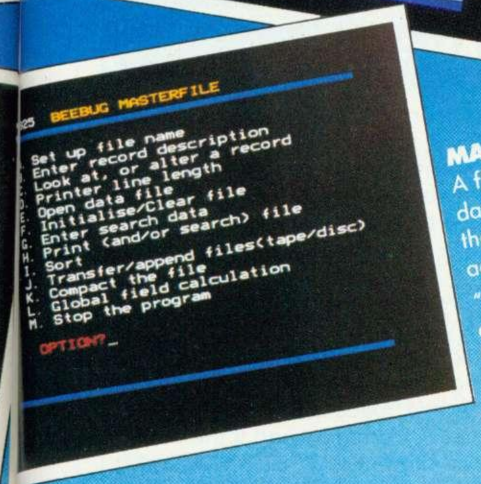
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TRENCH WARFARE

'Trench', Virgin Games, BBC B, £7.95

YOU have been chosen to destroy the invincible Termination Planet, which threatens the universe. Only one weak spot has been found, an exhaust vent, and you are given only one chance. You must steer your X-winged fighter along the trench, avoiding the alien ships and lasers. When you get close to the vent, your attack computer is engaged, and you must position the sights over the small hole, fire, and retreat.

The graphics are nothing special in *Trench* (written by Phil Wilkes), though they do the job sufficiently. You can see the eponymous trench – which scrolls quite nicely – your X-winged fighter, alien ships and firing lasers. At the bottom of the screen is a message centre which tells you how many miles to go and, after the game, what happened, eg, 'Hit by laser'.

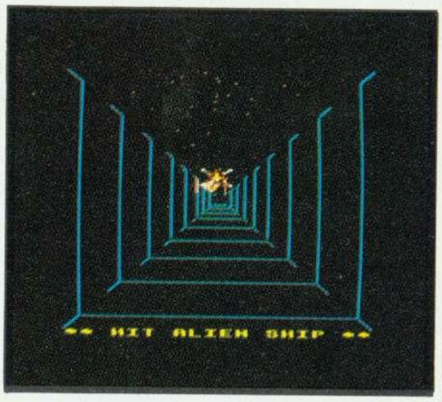
You can hear an engine noise all the time, the pitch of which varies with your altitude. There are other sound effects for when alien ships close in, lasers fire, for being killed, and for the run-up to the end of the trench before missile-release.

There's a joystick option, Clares or BBC but once you've selected keyboard or joystick you can't change, so if you enter Clares joystick when you have BBC you have to reload the game. There are nine levels of play. Increasing the difficulty level, makes the trench longer. There's no sound on or off option, or game pause.

The first few times I played *Trench* I found it much too hard, being hit by lasers all the time. I stuck with it, though, and now I can place a missile, though I usually get blown up along with the Termination Planet. Success seems to be random, depending on whether a laser hits you or not.

Trench is nothing special, with standard graphics, though quite good sound, and I feel it is too difficult.

Ian Brettell



SHAPING UP FOR THE COUNT

'One to Nine', Acornsoft, 4a Market Hill, Cambridge CB2 3NJ, £9.95

THE number of computer-assisted learning programs for the pre-school child is not large. ICL, under the guide of Acornsoft, has tried to do something about this one with *One to Nine*, a program designed to foster appreciation of simple numbers.

A different shape is used for each of the nine numbers, so the child will see ducks, teddy bears, trains, houses and a number of other familiar shapes, depending on the figure being illustrated. A stencil is supplied with the pack so that the shapes depicted on the screen can be drawn on paper to strengthen the connection between the two media. Instructions to this effect are displayed on the screen. The numeral associated with the number of objects is also shown, and a stencil shape is again supplied.

The child is asked to press the red function keys the same number of times as the number given. Different red keys give different shapes, in an attempt to remove any association that may be built up between the number and a specific shape. If the right number of keys is pressed before RETURN, a reward is provided in the shape of a yellow train, chuffing across the screen with the appropriate number of trucks. Options are offered to change the level of sound effects and to start with any of the numbers.

While the idea is sound and the images chosen are easily recognised and of a good size, the program is heavily over-priced. If it was included in a combined package or offered at about half the cost it would give reasonable value. As it is, a good beginner's book on basic numbers might be of more use.

I don't like the instructions on screen, which are neither clear nor of value to the child. This kind of instruction should have been included in the packaging. Also, the numerals are rather small, only about twice the height of a normal mode 5 character. The whole package suggests that its inspiration came from a programmer and not a teacher.

Simon Williams



SCROLLING INTO OTHER-WORLDLY DANGER

'A Maze in Space', Opus Software, BBC (32k), £9.95

HERE's yet another version of *Scramble*, though with a few changes and extra facilities. You must first fly up to the planet, avoiding its moons, meteors and defences. You then go down to the planet and seek and destroy your target, the alien command space station, shooting daleks, fuel dumps, rockets, and planet defence. *A Maze in Space* goes a step further with vertical scrolling, so you can go up and down into caverns.

You are told which state your target is in, but that can be quite a large area. You have only one life, as the game uses shields, which decrease if you bump into an object, and once they are at zero you're finished. Sometimes you get caught in a space warp, which returns you to your starting point.

Before loading the game itself, the game objects and full instructions are presented.

The graphics are fair, the objects being quite detailed and good use made of colour, though the planet's moons are only in block graphics and the maze drawing is flickery, especially going upwards. At the top of the display is your score, present stage, and state of shields, and during play the computer warns of failures to your guns, low shields, and lack of fuel.

A nice tune plays while the instructions are displayed and other effects during the game are similar to those of *Rocket Raid*. You can select sound on or off, joysticks, fast or slow game, fixed or random start position, and there's a freeze-game option.

A Maze in Space is a good attempt to improve on *Scramble* and if the flicker from the scrolling could be reduced it would much improve the quality of the program.

Ian Brettell

ROMS ON THE SIDE

Chris Drage compares ROM socket systems from NMC and Viglen that provide plug-in Beeb expansion on a budget

ONE OF the most important peripherals to follow in the wake of the BBC micro is the sideways ROM socket board. A number of multi-socket boards have been available for a while now: ATPL, Sir Computers and Watford Electronics have all produced 12-socket boards. A problem associated with some of them is power drain on the host micro, for the Beeb wasn't designed to house such equipment. Another problem is that the physical limit to the number of ROMs available is 16. 'Sideways RAM' has been one answer to the problem, but this means an outlay of up to £45.

For those on a budget there's now another alternative. Both National Micro Centres and Viglen Computer Supplies have stepped in to provide a single exterior sideways socket into which ROMs/EPROMs are simply and quickly inserted. The former has opted for a zero insertion (ZIF) socket, while the latter has taken a more novel approach.

The Viglen socket is really a cartridge ROM edge-connector that is connected via a ribbon cable to an internal ROM socket. Each ROM/EPROM is housed within its own cartridge and simply slotted in when required.

I wanted to see how each system stood up in general use, so I put each in a primary school computer for a fortnight and allowed the children to use *Edword, Disc Doctor* and *Printmaster* for various tasks.

The ROM extension socket from National Micro Centres comprises an extension cable with sockets, a ZIF socket, two pieces of double-sided sticky tape and an 'ashtray' aperture cover (figure 1). The system is designed for ROMs/EPROMs to be effortlessly inserted without damage to their legs or to the socket connections. The system is a little more tricky to install but, following the simple yet adequate instruction sheet, it took only 10 minutes.

At the Beeb end a 28-pin socket fits into 1C 52, where Basic usually resides. The socket uses round pins, which are both strong and safe for the main board socket. I was very pleased to note that NMC had not opted for the large, square-pinned plugs that do so

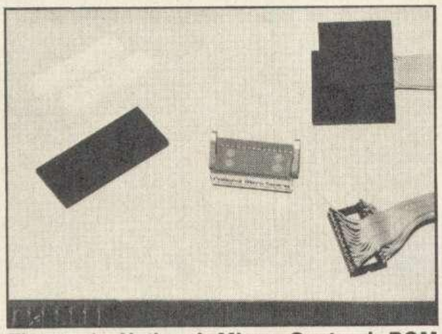


Figure 1. National Micro Centres' ROM extension socket system, consisting of extension cable with socket, ZIF socket, 'ashtray' aperture cover and sticky tape

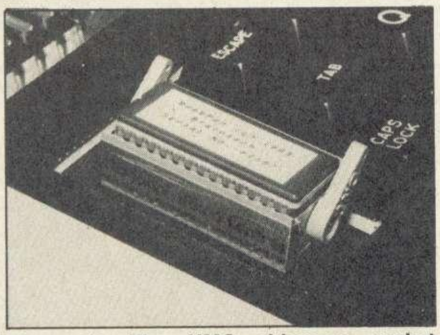


Figure 2. The NMC sideways socket installed. The board is attached to the underside of the keyboard cover with the sticky tape

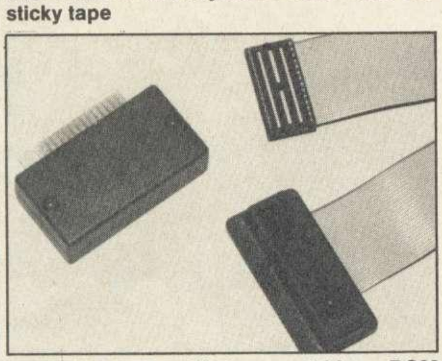


Figure 3. The Viglen cartridge ROM system, showing extension cable with socket and cartridge

much damage (remember the old OS 1.00 EPROM board!) To this a double ribbon cable is soldered and passes over the recessed area beside the power supply to the 'ashtray'. At this end a small board contains another 28-pin socket into which the ZIF socket will plug. Here the whole operation became rather amateurish.

The board is attached to the underside of the keyboard cover by double-sided sticky tape. It worked, but I found that after a while it became weak either due to rough treatment or the warm working environment. With the keyboard cover replaced the ZIF socket is plugged in and all is ready (figure 2).

Unlike the Viglen cartridge, the ZIF socket is not clearly marked as to which way the ROMs are to be inserted. The rule is implicit: keep the ROM's notch away from you. However, one teacher got it wrong and one 2764 EPROM was ruined. A clearly labelled socket would have avoided this.

In use the system did not always function with all firmware. It appeared to work with some EPROMs and not others. Unfortunately, the *Edword* ROM would not function at all, even after calling it with *FX 142,12, which should initialise any firmware in this socket. This problem is probably due to the fact that no additional circuitry is included to provide for data loss over the length of cable. Unfortunately, the computer must be switched off before a chip can be inserted/removed. Apart from the inconvenience it is yet another easily forgotten operation that could lead to the loss of an EPROM/ROM.

My overall impression of this system is not one of confidence. I was disappointed with quality of the ZIF socket and the presentation of the system.

The Viglen sideways ROM cartridge system comes solidly packed in a plastic case and comprises a ROM extension cable and socket, an empty cartridge, a cartridge storage tray and various covers for the socket, edge connector and the Beeb's 'ashtray' (figure 3). Following the simple instruction sheet Viglen provides, installation was easy and non-traumatic. The computer end of the ribbon cable is provided with a specially tooled 28-pin plug that is simplicity itself to insert, thanks to the excellent cable connection and its strong rounded pins. The ribbon cable proved long enough to run just under the keyboard edge and emerge by the loudspeaker and it didn't foul any components. The edge connector is provided with two flanges, each of which engages within the 'ashtray' slot to the left of the keyboard (figure 4). This results in a surprisingly strong and neat socket. Five minutes

and the job was complete.

Each ROM is now ready to be installed in its 60 × 20 × 30mm cartridge (figure 5). This is achieved by removing two screws from the cartridge top and pushing the ROM into a 28-pin socket mounted on a small printed circuit board. Correct orientation is aided by the suitable markings on the base-plate. Each cartridge includes additional components to allow for any losses across the data cable. This adds to the production costs but Viglen has made a wise decision to include this feature. As a result, the three cartridges used by my class of ten-year-olds performed faultlessly over the two-week period, passing the standard 10-year-old 'dropping', 'standing-on' and 'handling' tests.

Two features of the system I particularly like are the fact that it takes no additional power from the BBC micro in its operation and that cartridges may be inserted or removed with the micro switched on and working.

In case the owner wants to remove the socket from the computer, Viglen provides a blank plate to cover the aperture. This clips into the 'ashtray' and is unobtrusive. As the user's cartridges grow in number, each may be stacked in the storage tray.

Overall, this is a very successful system that met with the complete approval of children and staff.

Both the NMC and Viglen extension sockets provide a cost-effective alternative to multi-socket boards, if you don't mind swapping firmware in and out of the computer as required.

A problem of using a sideways socket system in a school environment is that cartridges/ROMs can get misplaced, and the possibility of theft must also be taken into account when using these systems in a 'public' environment. These problems however, must be weighed against the advantage of having expensive firmware quickly and easily available to swap among any number of suitably fitted computers.

Having used both systems over the month, I can recommend only the Viglen ROM cartridge system for school use. Each element is well designed, strongly built, and functions faultlessly. The risk of handling ROMs/EPROMs is too great to be a viable proposition: the extra expense of each cartridge must be measured against this. Also, as the ZIF socket cannot be relied on to work with all ROMs/EPROMs, its application must be limited.

For the home user, each of these ROM sockets appears to be a useful answer to the problems posed by the plethora of ROM-based software now available. Obviously, the NMC ZIF socket means that ROMs/EPROMs may be quickly and conveniently inserted and removed. However, the onus is on the user to provide safe handling and storage for his/her firmware. The problem is not so acute with the Viglen system as each ROM is well and truly protected. Whether the cartridge system is worth the extra cost is up to the user to decide.

REVIEW SUMMARY CHART

FEATURE	VIGLEN CARTRIDGE ROM SYSTEM	NATIONAL MICRO CENTRE ZIF SOCKET
Design & construction	4	3
Installation	4	3
Performance & reliability	5	2-3
Insertion & removal of ROMs	5	3
Documentation	4	4
Application	– education – home user – laboratory – small business	– home user – laboratory
Other peripherals	– cartridge storage system – switchable 4 × cartridge (board planned)	– none
Value for money	4	3

KEY: 5 . . . *Excellent* **4** . . . *Good* **3** . . . *Satisfactory* **2** . . . *Poor* **1** . . . *Very bad*

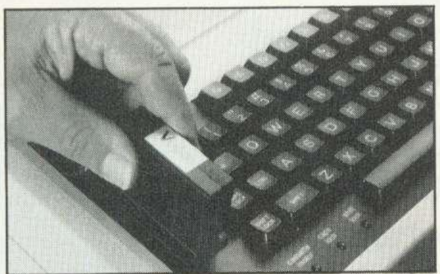


Figure 4. Inserting a cartridge into the Viglen socket

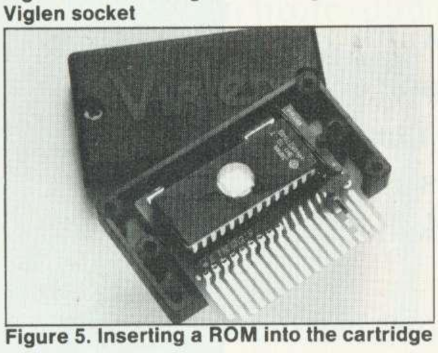


Figure 5. Inserting a ROM into the cartridge

DATASHEET

Product	Sideways ROM cartridge socket
Manufacturer	Viglen Computer Supplies
Socket type	Edge connector
EPROMs supported	2764 and 27128 EPROMs
Cable length	470mm
Special requirements	ROM cartridges
Price	Socket: £19.95 inc. VAT Cartridges: £6.95 inc. VAT £4.95 each for 10 cartridges
Review copy from	Viglen Computer Supplies, Unit 4, Trumpers Way, Hanwell W7 2QA.

Product	Sideways ROM socket
Manufacturer	National Micro Centres
Socket type	Zero insertion force (ZIF) socket
EPROMs supported	2764 and 27128 EPROMs
Cable length	420mm
Special requirements	None
Price	Socket: £19.95 inc. VAT
Review copy from	National Micro Centres, 36 St Peters Gate, Stockport SK1 1HL

Rebalance this sh

The BBC Micro can now give an astonishing new account of itself.

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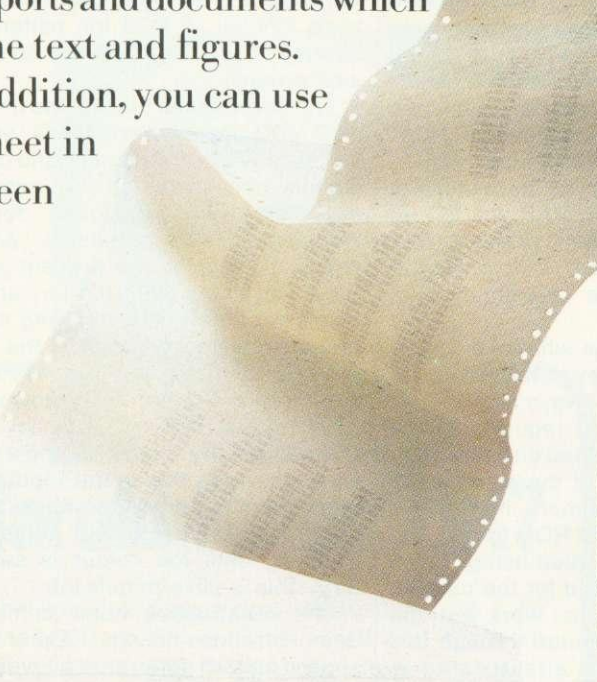
ViewSheet is also compatible with Acornsoft's View word-processing package. This enables you to produce reports and documents which combine text and figures.

In addition, you can use ViewSheet in any screen mode, making the most of the BBC Micro's potential. And if you use it with the 6502 second processor, you'll have no less than 30K of workspace in any mode.

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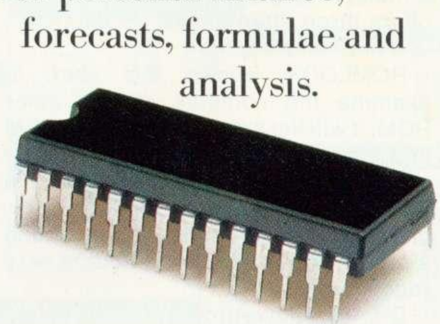
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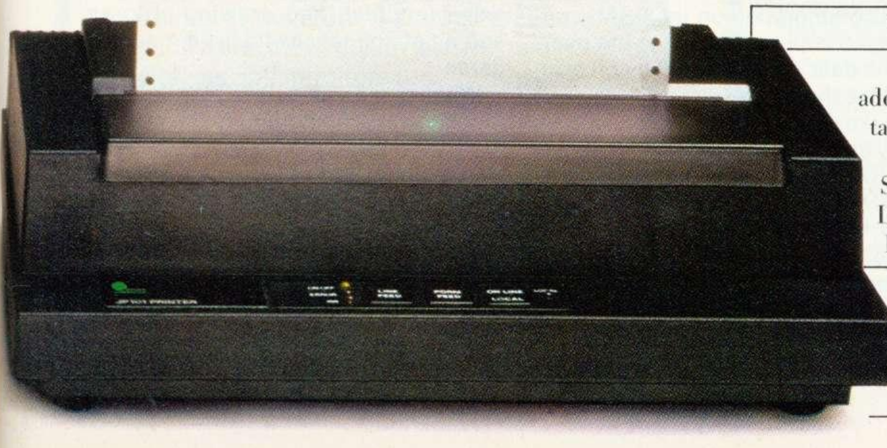




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ViewSheet's operations and functions in brief.

The operations supported by ViewSheet are: addition, subtraction, multiplication, division, exponentation and bracketed operations.

And the functions supported are: ABS, ACS, ASN, SIN, SGN, RAD, ATN, COS, DEG, EXP, INT, LN, LOG, PI, SQR, TAN, MIN, AVERAGE, MAX, CHOOSE, LOOKUP, COL, IF, READ, ROW and WRITE.

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WRITER'S WP FOR THE ATOM

'Editor' ROM Bearsoft (Bear Hardware, 68 Harmondsworth Lane, Harmondsworth, Middlesex UB7 0AA, tel: 01-897 3059), £35 plus VAT

NEW FOR the Atom is the *Editor* ROM from Bearsoft. A 4k EPROM, addressing at #A000, it is a refinement of, and replacement for, Acornsoft's *Wordpack* ROM. It comes with a full instruction manual, very well written, and a new keytop to replace the backslash key.

The *Editor* is a wordprocessing utility and stores text in a file from #3000 onwards, displaying it in upper and lower case on a mode 4 screen. By dispensing with several duplicate commands in the old *Wordpack* and omitting the TEXT function, a number of new facilities have been enabled. The most obvious thing is the new keytop. This is in white plastic and engraved with the symbols C/P. As in *Wordpack*, control codes can be put at the start of any line to serve various functions. These are now preceded by an inverse C, plus an inverse P if they are to be sent to the printer. This makes them very easy to see in the text display.

Many of the old functions have been retained. New commands are:

(K)ILL – deletes text from cursor to end of file
(Q)UIT – run a basic file at the specified address
(L)EN – address of first free byte
(W)ORD – displays word count, followed by L
(I)NFO – does a dummy print run then displays format information (page number, number of lines left; word count; first free byte)

Pressing COPY (to store text) displays the address of the first free byte.

The new commands might not seem much, but the difference they make is remarkable. They turn the *Editor* into a real writer's wordprocessor. Doing a dummy print run can save an awful lot of draft copies and the ability to use Basic to add extra functions is a real treat. In my work, the ability to write very large files in sections then call and print them sequentially from disc using the Basic program given in the manual is a real time-saver. I set it going and leave it to run itself.

The Bearsoft *Editor* is well thought out and lifts the old *Wordpack* to new heights. **Barry Pickles**

BUFFER MAKES ROM VALUE FOR MONEY

Buffer and Backup ROM, Watford Electronics, £18 plus VAT.

THIS ROM is one of the latest to be offered from Watford, and comes with an eight-page manual explaining its functions. The ROM can be !BOOTed using SHIFT LOCK-SHIFT and BREAK. A menu is displayed on the screen that offers three alternatives: 'ROMLOOK', 'D-TAPE' and 'TCOPY'.

ROMLOOK allows the user to examine the contents of any other ROM. It will list the contents of any ROM in a similar format to the disc *DUMP command, but unfortunately where the ASCII code is a single digit, the program does not compensate by inserting a space or a 0, so the printout is very ragged.

D-TAPE allows programs to be selectively transferred from a disc (or a series of discs) onto a tape. It will, if required, put a menu at the start of the tape for easier program selection. This menu program was very basic and would have benefited from attention to layout. The user is able to select the files to be listed on the menu. This means that data files need not appear on the menu.

TCOPY is a program to transfer tape files to tape, disc or Hobbit. I could not get this to work at all. It simply came up with the 'Header?' message and would not load tape files that I know will easily load from tape. I suspect the problem is connected with the sideways ROM board slowing down the timing.

The ROM contains two more utilities, *VAR and *BUFFER. *VAR will list all the variables and their values. Array variables are listed, but only the number of elements and dimensions are shown.

*BUFFER for me is what makes this ROM value for money. It makes use of any RAM on the sideways ROM board as a printer buffer, if required. When the computer is switched on a message appears at the top of the screen displaying the free memory in RAM, if RAM is present on the ROM board. The printer buffer is activated using *FX5,3 when all data destined for the parallel printer port (it does not work with the serial port) is first routed through this memory space. Once all the data has been accommodated on the RAM, control of the computer returns to the user, while the data is sent out bit by bit from the RAM to the printer.

To make use of this facility one needs not only the ROM chip, but either one or two 8k RAM chips (at £40 each) as well as a ROM board. This is still cheaper than buying an 8k or 16k printer buffer, and one then also has use of the extra RAM for other purposes. Some ROM boards will accept RAM only as two 8k chips, whereas others will accept 1 8k RAM. **Martin Phillips**

AMPERSAND ADDS COLOUR BOARD

Ampersand Colour Module, Atom, £13.75 (kit). Ampersand Computers, 86 Neal Road, West Kingsdown, Kent TN45 6DQ.

OBSERVANT readers may have noticed in the small ads section two gentlemen, Messrs White and Worrall, offering construction details for a cheap colour module for the Atom. It can now be revealed that these gentlemen are known collectively as Ampersand Computers (another *Acorn User* scoop!) and their board has now been put through its paces.

It is offered in four packages, to suit every level of competence. The one tested was a ready-built board, but we also built one ourselves, using the notes provided. Construction is reasonably straightforward for anyone with any experience and the parts used are all standard components, readily available from any decent supplier – ours cost £8 to build, excluding the Veroboard. (The ready-assembled unit costs £21.50). A PCB foil pattern and overlay is provided and the notes are well written.

The board takes the signals from the 6847 VDG and converts these, using a series of TTL components to the correct signals necessary for PAL receivers (the 6847 was designed for the American NTSC standard). All the necessary signals are present on PL4 (*now* you know what it's for) and the board plugs into this, allowing it to be mounted inside or outside the case. Anyone who has ever tried to remove the Acorn colour card will know what a blessing this is! One capacitor is removed from the Atom PCB and a single wire inserted – this is the input to the Astec modulator. After that, it's a matter of setting up and adjusting a trimmer, until the colour is satisfactory – this is a five-minute job.

The construction notes come with demonstration listings. There is a superb pattern generator, a lovely (and extremely fast) flag drawing program and an absolutely awful 'fruit machine' game.

What about the colour? Well, it was found to vary, according to the make of TV used. However, the colour register was as good as the Acorn board, if set properly, but with none of the problems associated with that board.

All in all, a nice design and one to be recommended. Even if you buy the ready-built version, it is still excellent value.

Barry Pickles

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Electronic News

Programming the Electron

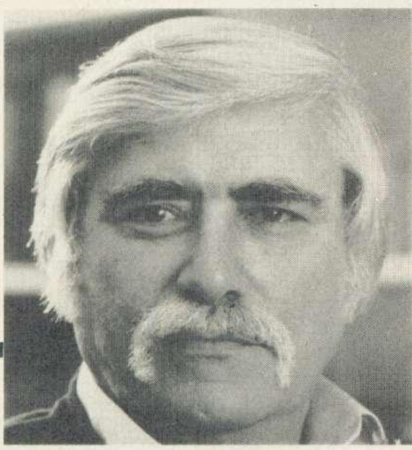
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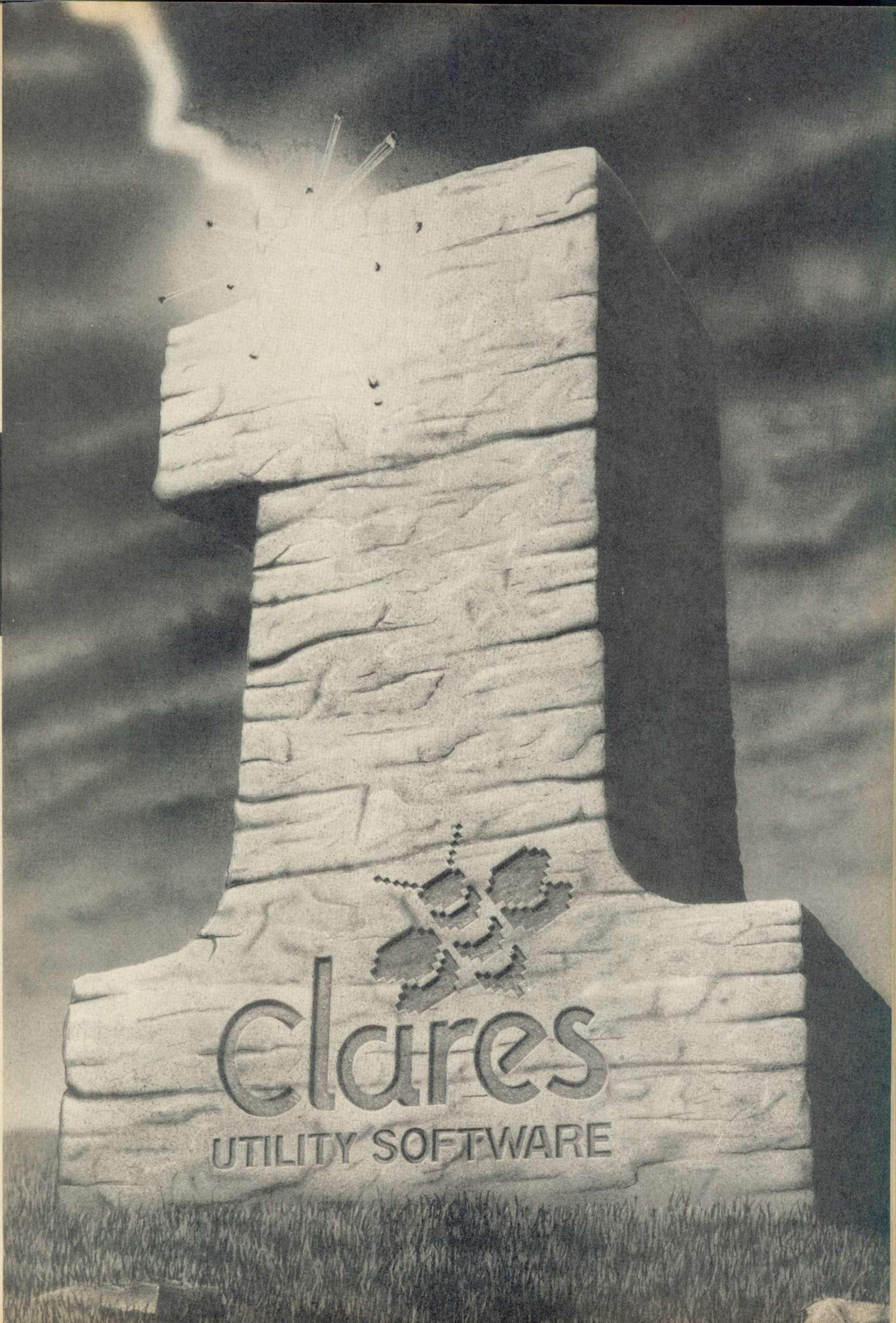
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West Yorkshire WF1 3PL

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Tel: 01-661 5031

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Ordnance Street
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Abraham Moss Centre
Crescent Road
Manchester 8

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Woodberry Down
London N4 1QN

✓ John Wood
Atom Users' Group of Canada
812 Cabot Trail
Milton
Ontario L9T 3M8
Canada

✓ Austin Vaughan
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35 Monastery Drive
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Dublin 22
Eire
Tel: (01) 593112 (evenings)

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Essex SS12 0NW
Tel: 03744 63396

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Bracknell
Berks RG12 4DX

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Huddersfield
West Yorks HD7 1XF

■ J. Smith, Secretary
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30 Leicester Villas
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E. Sussex BN3 5SQ

✓ Mr Ric Keyworth
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London NW6 5UL
Tel: 01-734 9235
(7am-3pm Mon-Fri)

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Oldbury
West Midlands B68 0QZ

■ Mr J. Price
Bedford House
27-28 St George's Road
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■ Mr P. Beverley
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Room 12a
Norwich City College
Ipswich Road
Norwich NR2 2LJ

■ Keith Mitchell
Edinburgh ZX Computer Club
19 Meadowplace Road
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Tel: 031-334 8483

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Polytechnic of North London
Holloway
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Tel: 0376 515609
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■ Mr P. Frost
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Tel: (0223) 811487

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S-175 33 Jarfalla
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We've been absolutely inundated with Free ads — something like four times as many as we can carry. This has led to long delays in publication and disappointment for readers. The free ads are carried in the magazine as space permits, so please allow up to four months for yours to appear.

Acorn User has been alerted to the abuse of the free ad service and, regrettably, can no longer accept entries selling or swapping software.

ACORN ATOM for sale. 12K RAM, 16K ROM, A&F Utilikit, games, programs and notes. One key damaged. Sell for £100 ono. Tel: (061) 491 2669.

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ATARI 400 with Basic cartridge, Atari 410 programme recorder, self teaching guide and reference manual, two games, pair of joystick controllers, excellent condition. All for £220 ono. Tel: Abingdon (0235) 31866 after 6 pm.

ATOM Acorn Wordpack in original case with manual. £16 ono. Tel: 051 652 9376 after 6 pm.

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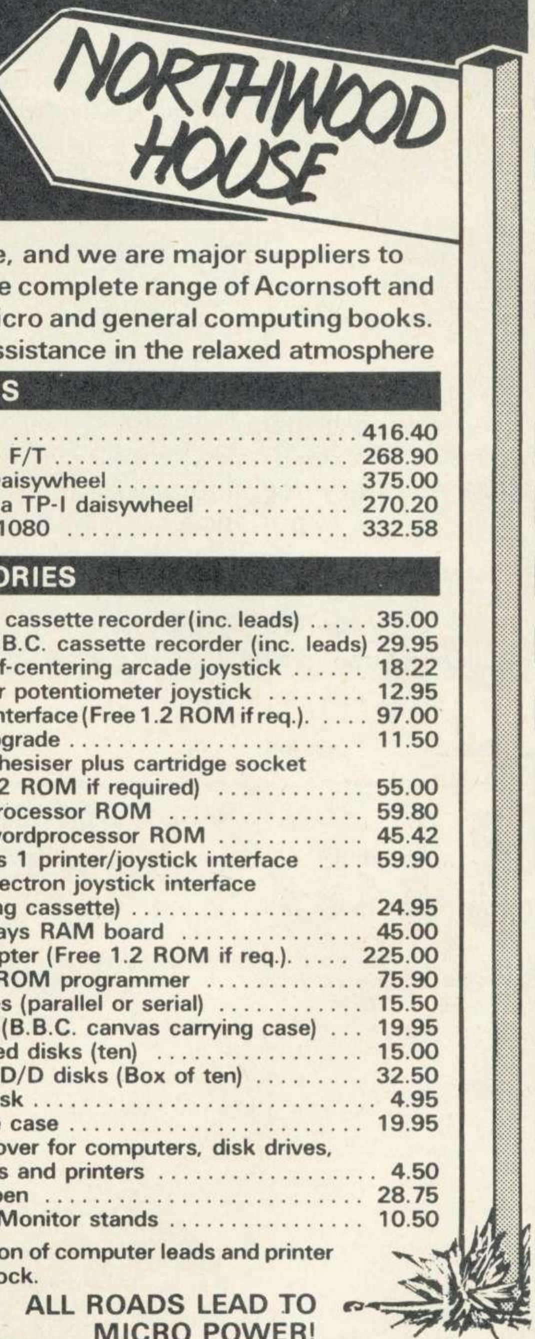
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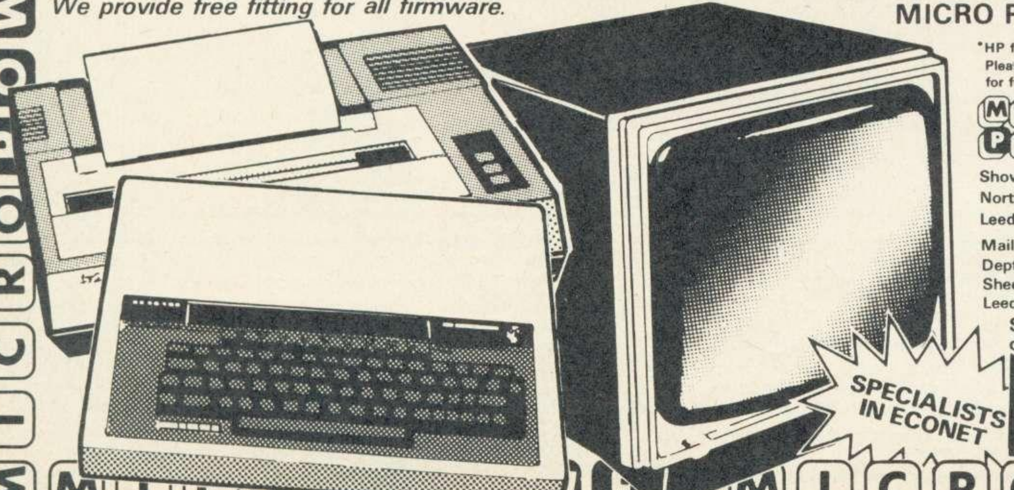
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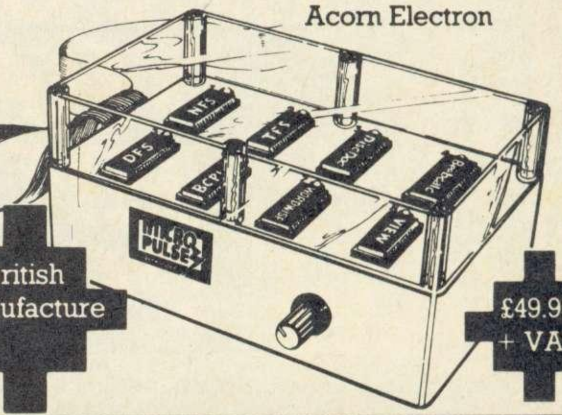
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ACORN USER ADVERTISEMENT PAGES – OCTOBER ISSUE

AB Designs	142
Abacus Business Machines	161
Abacus Soft	82
Acorn	90
Acornsoft	188/189
Acornsoft	16/17
Acornsoft	178
Addictive Games	154
AJ Vision	152
Akhter	48/49
Akhter	14
Ariadne Soft	204
BBC Publications	6
Beebug	192
Beebugsoft	88/89
Beebugsoft	180/181
Benwick Electronics	202
Brother Industries	87
C-Tech	63
Cambridge Microcomputer Centre	80
Care Electronics	118
ChaseData	176/177
Cheetah	72
CJE Micros	122
Clares	194/195
Clwyd Tecnics	80
Colisoft	203
Communitel	60
Computer Concepts	116/166/198
Computerama	52
Computerlink	191
Computerwise	121
Control Telemetry	54
Corgi/Addison Wesley	164
Cumana	11
CYB Design	66
Data-Technology	12/13
Database	73
Dataefficiency	31
Datapen	138
Datastar	129
Datastore	191
DE Systems	199
Diamondsoft	186
DRG Business Systems	171
Duckworth	178
ECCE	186
Elbug	128
Electronequip	92/93
English Soft	82
Epic Software	193
Garland Computers	172
GCC (Camb) Ltd	140
Gemini	25/26
Golem	186
Griffin	191
GSL	136
HCR Electronics	50
Highlight	204
Icon Soft	28
Infrascope	126
Intec	1
Intelligent Interface	134
Interface	162
John Wiley & Son's Ltd	184
Kansas	64
Keyzone	129
Lincoln Micros	168
Loco Systems	148
LVL	IFC
Mayday	203
Mayfair Micros	200
Merlin	183
Micheals Business Systems	66
Micro Management	55/56/57
Micro Repair-Club	34
Micro Test	78
Micro-Advent	186
Micro-Investor	54
Micro-Resources	202
Microbyte Soft	68
Microfast	156
Microfix	152
Microman	138
Micropower	OBC/32/71/205
Microstyle	124/125
Microtek	161
Microvitec	8
Microware	75
Musicsoft	34
Newark Video	162
Newnes Technical Books	191
Northern Computers	206
Opus	34/115/127/142/196
Pace	174
Paw Systems	66
Peter Sharpe	204
Phimag	4/5
Proxima	50
Quxstor	202
Racey Designs	203
Raven Micro-Products	158
SCI (UK)	76/77
Screens	199
Shards	132
Shiva Publishing	184
Shumwari	178
Silent Computers	162
SIR Computers	150/154
Skywave Soft	150
Social Science Software	199
Software Supermarket	91
Solidisk	36/37
Statacom Distribution	193
Superior Software	IBC/74/163
Synergy	84
System	131
Systems International	58
Tandy	163
Technomatic	74
Three D Computers	200
Trade Link (UK)	34
Viglen	143/145/147/149/151/153
Vine Micros	127
Virgin Games	71
Voltmace	205
Watford	OBC
Wessex Micro-Computers	116
West Coast Personal	140

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ACORN ABUSER'S Diary

Astounding action by Amstrad

IT IS unusual for Acorn Abuser to benchtest machines from other manufacturers, but this month we make an exception for the Amstrad H1f1. This machine is so different from conventional micros that Hermann Hauser was heard to comment 'Was ist es?'.

Imagine a machine with no monitor or qwerty keyboard, but physical icons, in-built radiowave interface and three-speed disc drive and you'll realise why Kai Gooney will describe it as 'the shape of things to come' next year.

The principle behind the machine is distributed computing. Whereas current home micros have a central microprocessor driving the memory chips and peripherals, the H1f1 has peripherals which drive themselves. The central board merely focuses the current input device to the current output device. Amstrad calls this central board the 'amplifier', a term soon to become a household word.

The input devices are a three-speed disc drive, cassette recorder and switches and dials on the amplifier. Of these the disc is the most notable. It is an internal Amstrad design and the company has made a surprising choice.

According to a spokesman the 'turntable' (Amstrad name for disc drive) will take either 7in or 11in discs at any of three speeds – 33, 45 and 78rpm. With most makers going for 3in or 3.5in drives, this may seem surprising. However, Amstrad is hedging its bets, as the spokesman mentioned the possibility of a 'compact' disc, presumably 3.5in.



H1f1: icons, radiowave interface? three-speed disc drive

Even more amazing is that the discs are read-only serial access, surely the biggest quantum leap backwards since Sinclair microdrives. The large surface area does however give a massive storage capacity and, at 78rpm, performance should be better than the aforementioned microdrives.

Rather than going for boring colour monitors as output devices, the H1f1 has a pair of 50-watt loudspeakers with optional earphones. This results in astounding sound effects for a new range of arcade games, although experts believe colour graphics could be difficult. Amstrad do sell colour monitors, but these only receive BBC programmes, so there is obviously an Acorn link-up here.

Software authors will have to learn new skills, as the H1f1 has a non-standard Basic. We'll describe it later on when we have worked out how to use it.

Amstrad makes it clear that most conventional programming languages are no good because they have no structure comparable to the basic of the H1f1. Whilst it is incredibly simple to program the H1f1 to produce sounds identical to the human voice or musical instruments, it will take time to generate any numbers.

The system software design is brilliant. Amstrad has reassuringly continued the policy of releasing products when they are finished. Consequently the operating system is not 0.1; it doesn't hang off the back of the machine, in fact it doesn't exist at all. A look inside the amplifier proved there are no standard microprocessors, ROMs, or RAMs, but cheaper, less sophisticated circuits.

After detailed analysis Acorn Abuser found that the work of a processor and the obligatory 64k of RAM was all being done by a single transistor. Damn clever.

Amstrad has recognised the need for machines that will communicate with each other and has provided an ingenious solution. Rather than opting for network interfaces which are slow and localised, H1f1 has a radio interface called a 'tuner' (something of a misnomer because it can do nothing with tunes). Software is input via the tuner and processed directly without the need for storage on cassette. However, software can be saved onto cassette and Amstrad claims this could cut costs by 90%, so software houses should rush to support the H1f1. Hmmmm. The tuner shares the same irritating limitation as the disc drive in being read-only, but we are sure an enterprising company will produce a cheap writable tuner.

Envelope of the month

Ms. Cherry Hinton
Acorn Computers, Ltd.
Fulbourn Road
Cambridge, CB1 4JN ENGLAND

Envelope as addressed to Acorn from Microscape-84, Texas

■ALL these business machine rumours! According to the rags it's an Advanced Business Machine, it's an Acorn Business Machine, it's a Personal Workstation Range, it's based on the 6502, it hasn't got a Z80, it has got a Z80, the big one's a 68020, it's a 16032, it's an 80286. Of course, prediction is a little difficult when Acorn are so secretive. But if you read *Acorn User*, it's as easy as ABC.

■DOES *Oric Muser* know something we don't? We're just hearing reports from the Palace that as well as Prince Andrew being an *Aviator* addict, Prince Charles is dating a girl called Diana. . .

■MARKETING man Tom Hairbrush has received an apology from *Computer Weekly* over an article they published naming him 'Tom Hamburg'. Uncle Tom, as he's known to his friends, described the article as 'the pits of journalism'.

■SPEAKING of pits, it's a trifle embarassing for Auntie Acorn when the Acorn-sponsored car crashes on Acorn race days. R&D are said to be releasing the 1.0 engine 'within a month'. (That's just longer than 28 days).

■MESSAGE to an Acorn director. Our Editor wants his £5 loan back – or he'll spill the beans about his guitar playing.

■ANOTHER Acorn director in trouble is Peter Winalot for blowing the engine on a Ford Caterham racing car on a practice circuit at Silverstone.

■HAD anyone heard of MSX before Chris Curry started being paranoid about it?

■IT WAS so nice to receive a postcard from Barry Woodentop on his holidays. He goes to Silicon Valley each year 'to get away from it all'. Oh Barry, if you're reading, there are two 'r's in 'squirrel'.

■WHY does Acornsoft's new marketing manager Jeremy Piston-Engine wear such outlandish bow-ties? Is he one of the *elite?*

■ASTOUNDING fact 1001: Computer Concepts boss Chas Moir is a carrot fanatic.

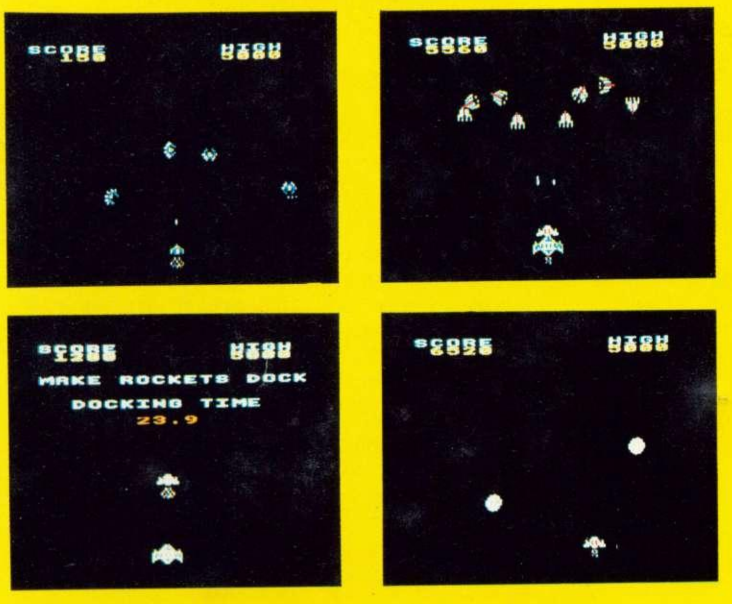
■TRIED typing the command 'daytona' in on View?

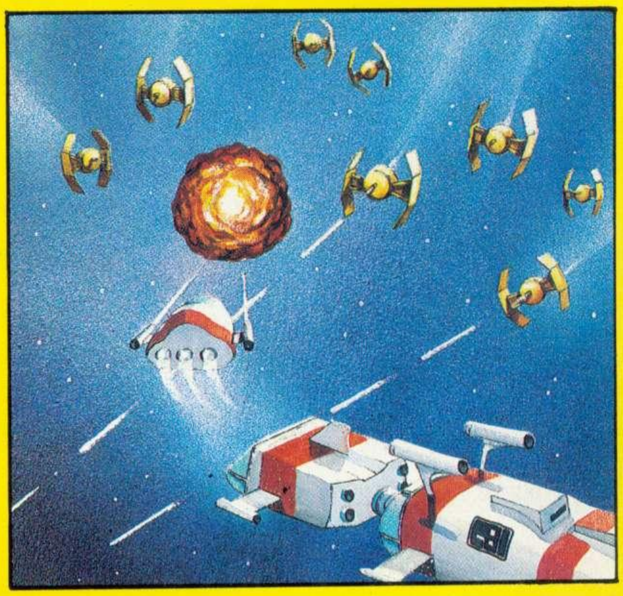
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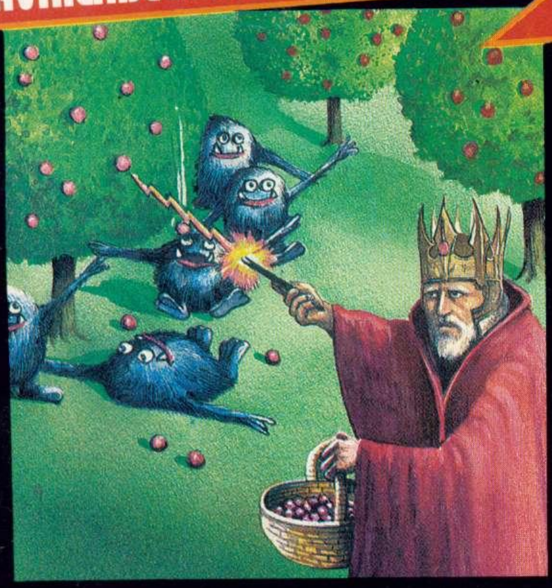


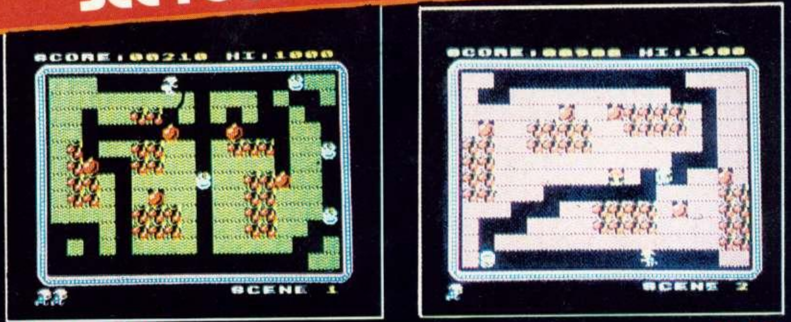


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